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Supply Engineers and the Grid.

REFERENCE was made in the Weir Report to the pernicious, but widely-held, view that less skill is required to manage an undertaking receiving a bulk supply than one operating a power station. We cannot help thinking that this view owes its origin, in part, to a false etymology. Often to the lay mind an engineer means a man who looks after engines; the inference is drawn that, if the engines are dispensed with, the engineer should be superfluous. This idea is akin to the vulgar error in supposing generating costs to be the only appreciable factor in determining the price to be paid by the consumer.

That the duties of the chief engineer and manager should be confused by the public with those of his station superintendent would be of little moment, if the representatives of the public were better instructed in the system of organisation for which they are ultimately responsible; as it is, the ignorance shown by some on this point is likely to be highly detrimental to the future of electricity supply.

A protest against the view referred to is raised in the September report to members of the I.M.E.A. in an article reproduced this week in our "Notes" section. It is there mentioned that undertakings, whose stations have been closed down, have reduced the salaries offered when making new appointments (and we would add, if we may do so without unfairly prejudging future actions, that the end of the wedge is thin). The fear is expressed that many of the best engineers will eventually be forced out of municipal employ, and this is an aspect of the position which Mr. Frank Hodges evidently overlooked when, at the I.M.E.A. annual dinner in June, he prophesied as promising a future for municipal as for company engineers.

The fact is, as the article points out, that the major engineering problem in connection with the supply of electrical energy lies in the reduction of distribution costs. Moreover, the capital spent on mains is appreciably more than that spent on power stations, while 62 out of every 100 men employed in supply work are engaged on work other than generation; in either case the disproportion is rapidly increasing.

But neither generation nor distribution is an end in itself. Statutory powers, as the Weir Committee reminded us, are given to authorised undertakers to supply electricity, and from that point of view its generation is of no more consequence than—to go one link back in the chain—the production of the coal used for raising steam. The supply engineer's primary duty is, therefore, to supply electricity, and his duties will

involve, to an ever-increasing degree, the highly technical study of methods of meeting the diverse requirements of industry and social life.

If the arguments against reducing the status of engineers of distribution undertakings are not accepted now, there is at least a possibility that they will be at a later date, when it may occur to "economists" to inquire whether the operation of a power station, with the assistance of a skilled generating staff, justifies a salary in excess of that paid to the managing engineer with no station.

So far we have tried to present the case for the individual, but there is another and even more important case—that of the nation. Whatever personal views may have been held concerning the legislation of the past few years, all meet on common ground in the belief that every effort must be made to ensure the success of the supply section of the electrical industry under the new *régime*, now that the Act of 1926 has become the law of the land.

The Central Electricity Board can require the closing down of a station only if a substantial saving can thereby be effected. There are bound to be many instances in which the margin is small, and it will manifestly be to the advantage of the scheme as a whole, and probably also to the undertaking itself, if the latter will agree to take a bulk supply without recourse to the delays and appeals which the Act, in order to avoid any semblance of injustice, allows.

The co-operation and good-will of the municipal electrical engineer will often be the deciding factor, but, if he be haunted by the fear of professional relegation, is it not asking too much of human nature to expect his views not to be subconsciously biased?

Even if it is true to say that this is the age of machines, the human factor is still, as indeed it always will be, the most important element in successful working. If many of the best engineers decide to find an outlet for their energies in other fields and are succeeded by less able men, while others of the right calibre who remain are allowed to become discouraged by the thwarting of their proper ambitions, then no matter what improvements are brought about in mechanical and electrical efficiency, they will not be enough to offset the deterioration in personnel.

There may be no direct legislative power to deter those local authorities who wish to do so from adopting a short-sighted policy in regard to the staff of their undertakings, but it is to be hoped that indirect pressure can be brought to bear to prevent injustice and also, it may be, national loss.

Government and Foreign Trade.

Several years ago when experience proved that the Foreign Office and its representatives abroad did not lend any particular weight to our overseas trade expansion efforts; also that the Board of Trade acting alone was unable to render all the assistance that was required by our manufacturers; the Department of Overseas Trade (Development and Intelligence) was formed for the purpose of acting as a liaison committee to collect the information that was available and serve it up more speedily and in a form more suitable for the purpose of the trader. That it has done good work in the past we have frequently asserted here; its good service continues to-day, but we are awaiting the fulfilment of the Government promise to help in the expansion of trade by some form of reorganisation. We find it somewhat difficult to understand why the National Union of Manufacturers (Inc.) has had to ask the Government to form a new trade branch of the Foreign Office, unless the liaison arrangement referred to above has failed. The National Union is in doubt whether the Foreign Office, or the Government itself, is giving an adequate degree of assistance to British manufacturers in their endeavours to obtain competitive orders in foreign countries, or whether such assistance, if being given, is rendered in the most effective way—for example, when inquiries are being made for contracts for the making of dams and other general utility work. What the Union members ask is that there shall be made available for their use an experienced trade branch situated in the Foreign Office itself. The Union is fully sensible of the valuable work of the D.O.T., with which it supposes that the proposed new branch of the Foreign Office would work, in promoting business abroad, but it feels that the Foreign Office and its ambassadors should take a more active part in promoting our trade interests, and make greater efforts to secure orders in foreign countries. Excellent as these suggestions may sound, they will be replied to by a Government which has in its archives all the earlier history, part of which we have referred to at the beginning of these notes. It is not less necessary, but more, nowadays, that information of an official character to assist traders should be served up "hot," instead of being delayed because of double handling of news. If that is the object of the Union it is a good one.

20-kV Cable Vertically Installed.

It is a British characteristic to avoid mention of a new development until it has been brought to a successful issue. This self-imposed restraint may account in some degree for the criticism often levelled at our manufacturers in regard to inadequate publicity, but it nevertheless helps to build up a name for ability to back assertions by established fact, and probably proves beneficial in the long run to the national reputation for reliability and sound design. Thus there need be no surprise at the fact that the first announcement of the installation of a mile and a half of 20-kV cable, nearly two-thirds of which are run vertically, should appear in the *Transactions* of the South African Institute of Electrical Engineers after proof of the reliability of the cable over several months had been obtained. This cable was put into service last February, and, as a result of the experience gained, a further installation of 20-kV cables on the property of the East Rand Proprietary Mines was tested and handed over in August.

The economies due to this departure will be obvious, in view of the heavy electrical demand in these mines—a demand that had previously to be met by 2,000-volt cables.

The construction of a satisfactory 20-kV cable of the ordinary type is not noteworthy in these days, but, we believe, the design of nearly a mile of cable at this voltage for vertical operation is something that has not been accomplished before.

It is also particularly encouraging, in view of international competition there, that South Africa should be the country in which this fresh example of British enterprise and skill has met with its reward.

We publish elsewhere in this issue some extracts from the paper by Messrs. W. Elsdon Dew and H. Denehy, which describes the special type of paper insulated cable made by Messrs. W. T. Glover & Co., Ltd., in which, it is claimed, the impregnating compound will not bleed. As a consequence, hydrostatic troubles are overcome without the necessity of employing any draining process during manufacture.

An Efficient Organisation.

The works of Messrs. J. A. Crabtree and Co., Ltd., which are described fully elsewhere in this issue, are an excellent example of what an "all-British" concern can be when the true British spirit is allowed to prevail. Unhampered by petty restrictions, the management, staff, and workpeople have gone ahead in a true spirit of works co-operation, and so brought the organisation to its present state of proficiency and efficiency. Works results and works "atmosphere" are very closely allied; one cannot leave after a tour round Crabtree's works with any doubt about that point, and the driving force which has been responsible for bringing about such a cheerful spirit of co-operation is deserving of any and all the fruits of the energies absorbed.

We congratulate Mr. J. A. Crabtree, the founder and head of the works.

A Factory for Small Switchgear.

Some Impressions of a Visit to the Works at Walsall of Messrs. J. A. Crabtree & Co., Ltd.

IT is refreshing to find a factory in the industrial centre of England that is so conveniently situated as the works of Messrs. J. A. Crabtree & Co., Ltd., who evidently realise that an up-to-date factory, in addition to being close to sources of supply of materials, labour and demand, should also, if possible, have a pleasant environment. The factory is believed to be the largest in the country devoted to the manufacture of small switches and accessories. From the front of the works the country stretches for miles in green meadows and cornfields, and the shrubs and flowers round the works are what one would associate more with a public park than an engineering establishment. Due to the Lincoln works being located on the fringe of Walsall, labour has to be drawn from a wide area, and a specially chartered fleet of omnibuses brings the employés from the outlying districts direct to the works' gates. It has been found that this is greatly preferable to leaving them to come by cycle and on foot, particularly during the seasons of bad weather.

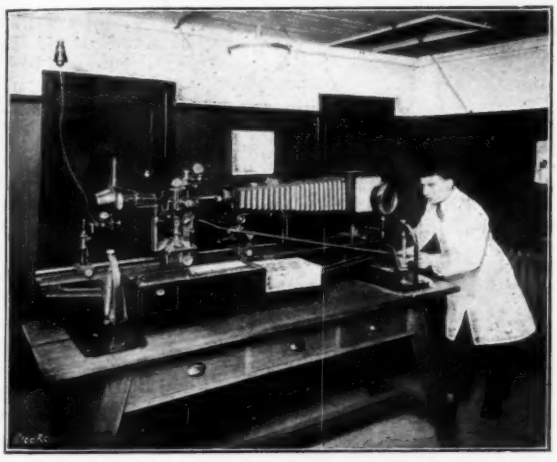


Fig. 1.—The Microscope Room.

Fig. 2.—Tool Room; Machine Section.

A bird's-eye view of the works, fig. 4, which was taken before the present extensions were well in hand, shows an excellent aspect of this modern factory. The ground area is over nine acres, and the floor space is over one hundred thousand square feet. When the extensions are completed, the floor area will be nearly 140,000 sq. ft. At the present moment, the firm has eight hundred employés, which number will be added to when the extensions are completed.

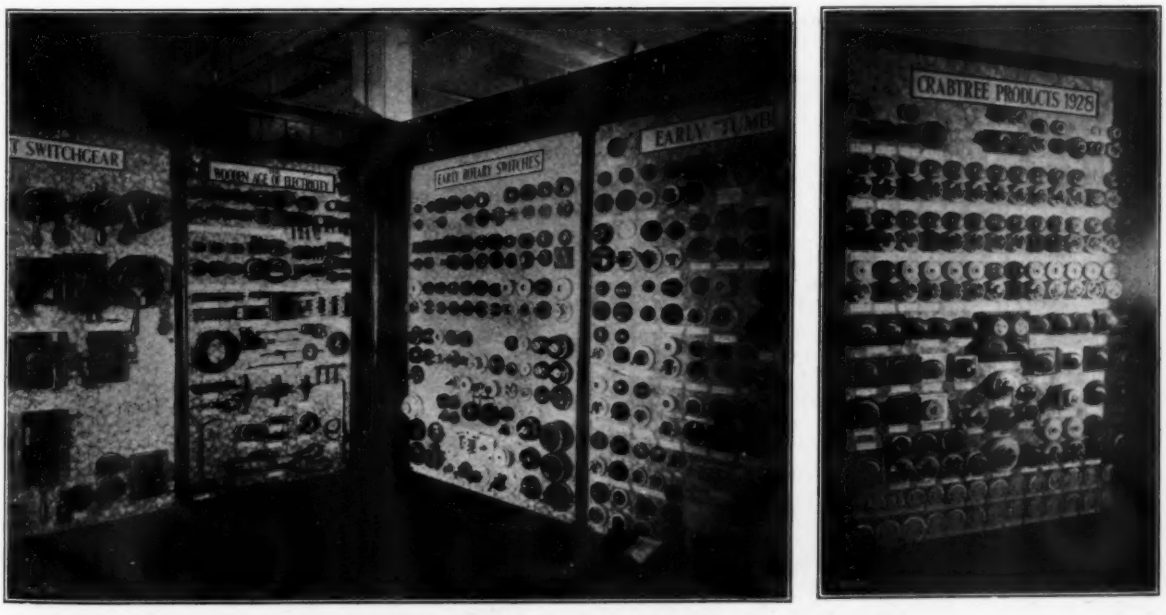


Fig. 3.—Ancient and Modern Exhibits in the Factory Museum.

The first thing that strikes the visitor, at any rate, if he is an electrical man, upon entering the offices is the

large number of lighting points that have been provided. The ceiling can be considered as a series of ceiling light-

Fig. 4.—Aerial View of Crabtree Factory.

ing outlets, each comprising a single-cord operated ceiling switch controlling an adjacent ceiling rose; these outlets are fixed at approximately six foot centres, permitting an entire rearrangement of the office desks and fittings, and yet provide quite convenient lighting sources to meet all exigencies.

To those who take an interest in the historical side of electrical wiring systems, electrical accessories, and small switchgear, quite a happy afternoon can be spent in examining the thousands of articles exhibited in the Crabtree museum, see figs. 3 and 5. These exhibits date from the beginning of the electrical switchgear industry, and take one's mind back to the time when insulating bases were made of boxwood, teak, and mahogany; when fuses were made of tinfoil; and when tumbler switches were filed up by hand from brass castings. The museum has recently been augmented by the well-known Parsons collection, which, among other things, includes a very interesting collection of early lamps. At one time there was some fear of this collection going to America, and those who are interested will be happy to realise that such articles are to be retained in careful and appreciative custody in the Old Country.

Fig. 5.—General View in the Works Museum.

In the manufacture of small electrical switchgear and accessories, the great problem is to maintain quality in every article produced, particularly when the quantity of articles to be produced is large. For that reason the firm has established research laboratories to ensure that all materials entering the works are capable of withstanding the stresses incidental to their particular manufacturing processes, and of a grade suitable for such operations as machining; after undergoing the processes they are to be suitable for embodying in the finished products. The laboratories are particularly well-equipped for the work; fig. 6 shows the chemical laboratory, and fig. 1 the microscope room. The microscope has a magnification of two thousand diameters, and is used for examining both the macro- and micro-structures of the materials used. The company conducts research work into the electrical qualities, both of the materials and of the complete products, much of the work being interlocked with that of the chemical laboratory. A design may be produced which is excellent electrically, but weak mechanically. The tumbler switch, for example, is a small electrical machine which, in its materials and construction, must have long life and ability to withstand reasonable hard usage. Its insulating properties must be sound, and its carrying and breaking capacities must be ample for the job. Immediately one detail is altered to improve one factor, it invariably weakens the other factors' condition. No insulator is perfect in all its mechanical and electrical properties, and the same has to be said of all the metals. The result is that the selection of materials—their shape, methods of manufacture, and assembly—has to be a compromise to produce the best all-round results. As an example of this we were shown a sample card on which were mounted the various experimental brackets made in the evolution of the "Crabtree Lincoln" switch. Each bracket had been mechanically tested to the point of breakdown, and it was interesting to see how the bracket had evolved from the original type which fractured at 15,000 operations, whereas the final bracket had been operated over one million times, without sign of fracture.

Fig. 6.—The Chemical Laboratory.

The two reproduced (untouched) photographs in figs. 8 and 9 are of particular interest in that they are of two metals that are absolutely identical from a chemical analysis point of view, yet it is abundantly clear how the materials vary. The one has received incorrect heat treatment and has been unduly stressed; the other is an almost perfect specimen of its class.

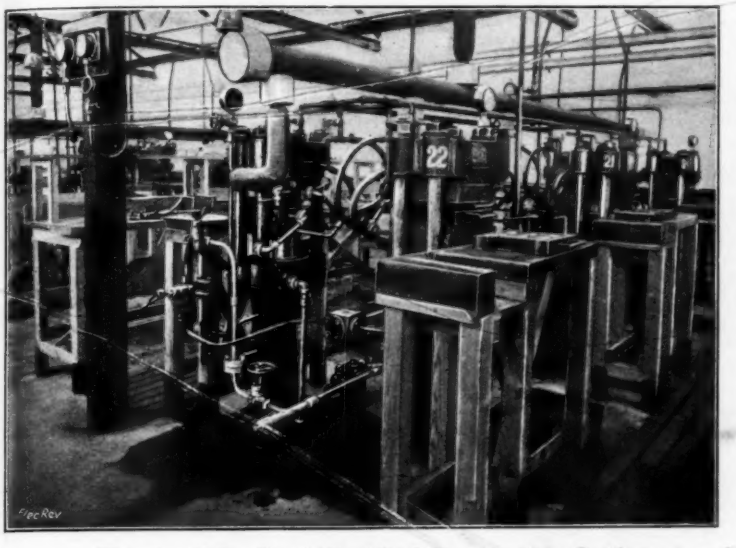
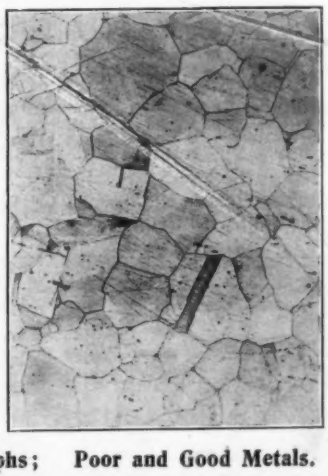


Fig. 7.—" Jacelite " Moulding Plant in New Section.



Figs. 8 and 9.—Micro-Photographs; Poor and Good Metals.

As would be expected in any factory claiming to be modernly equipped, electric motor drive is employed and 25-h.p., 400-volt, 3-phase ball-bearing motors are, with few exceptions, employed throughout, all having identical fixing centres and cable-entry arrangements. Pulley diameters and speeds are standardised, and a constant peripheral speed of the main-shaft driving pulleys has been arranged. At least two motors are always maintained as a standby. A distinct advantage of this arrangement is that all the motors are interchangeable, so that a new motor can be in operation within a few minutes of shutdown in the event of trouble.

The line-shaft sections are cut into 25-h.p. groups, and due to the load factor being high, the power factor of the complete installation is in the order of 0.85. This is, of course, improved when the lighting load is added, the supply being taken from a step-down transformer upon the premises. Fig. 12 shows one of the 25-h.p. motor drives, together with a low-voltage generator used in connection with the plating equipment.

There is a well-equipped test room, fig. 10. Apart from tests under working conditions in the factory, products are taken from each batch produced to undergo both electrical and mechanical tests. These are carried out at various operating speeds in order to find out definitely the effects of metal fatigue and the actual wearing ability of the components, even under the most onerous working conditions. For instance, the brass dolly and rocker arm carrying the switch-operation mechanism both operate upon a phosphor-bronze rod, this giving a reasonable friction-free bearing, and one that tests prove to wear particularly well. It is attention to these small details that have perhaps made " Crabtree " products so well appreciated. A 5-kVA transformer with voltage tappings from 1,000 to 2,000 volts, in steps of 200 volts, is in constant use. Every flush switch produced and every switch that has provision for earthing must definitely withstand a 2,000-volt test. For the heating effects of heavy currents upon switches, a loading up to 300 A is obtainable in the test department, whereas, if special tests are desired, loads up to nearly 1,000 A are in reserve.

Every product of the company has tests made on its insulation values, both during manufacture and before entering the warehouse department. Fig. 11 shows part of the apparatus employed for this purpose. A 230-volt a.c. motor drives a 1,000-volt d.c. generator. This is fed through an ohmmeter to the insulation under test. The instrument has a very open scale, and, whereas the average ohmmeter employed by the wireman has a scale that finishes at 100 megohms, and then passes to infinity, the ohmmeters employed in the instrument in question give due importance to the insulating values between 100 and 5,000 megohms. As evidence of the sensitivity of this apparatus, a piece of porcelain was held by hand for just a few seconds, and the moisture film that was deposited upon the surface of the porcelain was sufficient

Fig. 10.—Test Room, showing 2,000-V Testing Equipment.

to reduce the insulation value to between 500 and 600 megohms. It was almost uncanny to see this effect, and to watch the needle resume its infinity position as the moisture film dried out, due to normal and osmotic drying.

At the time of our visit the moulding department was in the process of moving into a new building, and only a portion of the plant is shown in the view of the new section, fig. 7.

The firm's range of "Jacelite" products has met quite a market demand, and perhaps one of the most surprising features is that the surface mirror finish of the product is directly produced in the moulding operations by the extremely highly polished surface of the moulds. The moulding powders are inserted in the dies and these are placed in the hydraulic presses, which have steam-heated platens that are maintained at a definite temperature, according to the steam pressure employed in conjunction with pyrometrical control. Pressure is applied from a high-pressure pipe line to each press, and considerable advantage is obtained by utilising a special oil instead of water, which is the more usually employed high-pressure medium.

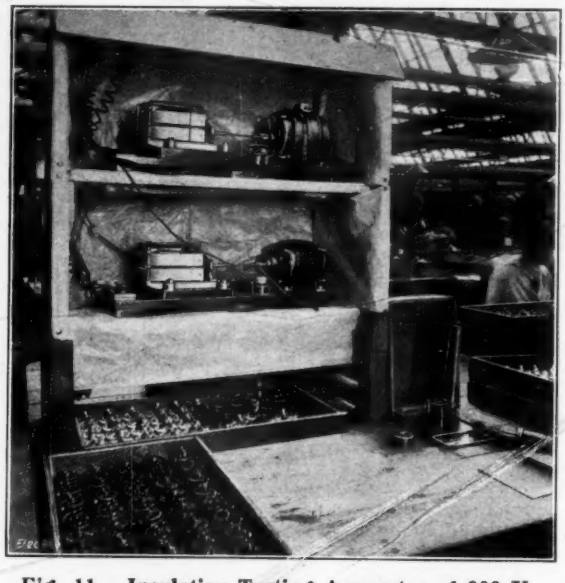


Fig. 11.—Insulation Testing Apparatus; 1,000 V.

Fig. 13 shows an electrically-driven three-throw vertical pump used in connection with the hydraulic plant.

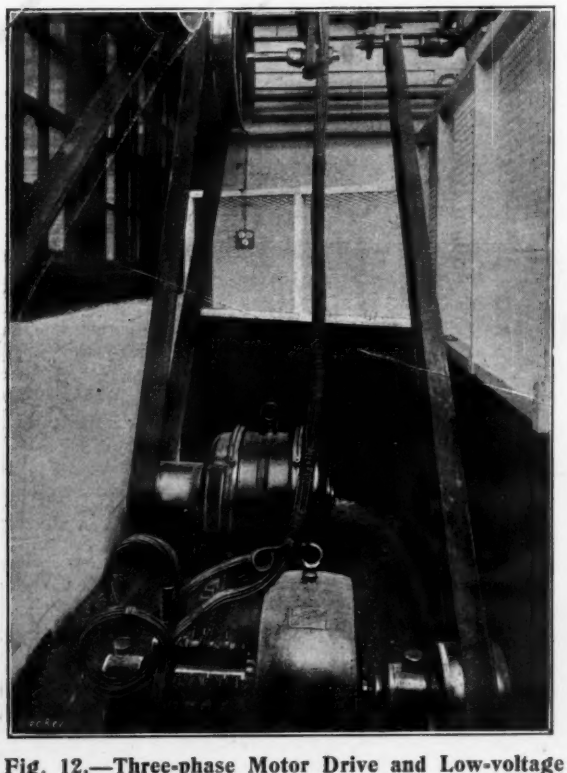


Fig. 12.—Three-phase Motor Drive and Low-voltage Generator.

The motor is controlled by a totally enclosed contactor-type starter, several ingenious automatic tripping devices being provided, so that the 80-ton hydraulic ram does not overlift.

In the automatic shop hundreds of thousands of screwed parts are required daily, and, as would be expected, a first-grade plant is employed for their manufacture. High-speed automatic machines have been installed for the accurate production of these small components. Screw threads to close limits can be cut at 3,500 r.p.m. When it is understood that the thread limits of a standard "Crabtree" terminal screw is required to be accurate within plus or minus one thousandth part of an inch in the thread diameter, and that considerably closer limits are required for pitch, it is easy to give credit to the workpeople concerned.

Drilling operations carried out at 14,000 r.p.m. without vibration would be of particular interest to the old-time mechanic, who had perforce to use much lower speeds.

As befits the general stores of a factory of this description, every mechanical facility is given for the efficient handling of the goods. In this connection it has been found that lead-acid batteries have given particularly good service. Possibly this is due to the lack of gradients, as the stores for each section are arranged for single-floor delivery.

With special counting machines at the disposal of the stores section, it is only a matter of a few seconds before a quantity of components can be rapidly determined. For instance, we found that it took only 7 or 8 seconds to determine that there were 9,860 components in a certain box selected by us.

Fig. 13.—Three-throw Hydraulic Pump.

We were interested to find that there is quite a distinct fashion in metal colouring, and that certain finishes have their cycles of fashion, which also vary in different parts of the country. To meet all these requirements there is quite a large plant devoted to this stage of manufacture.

For metal deposition, low-voltage current at 6 to 8 volts is taken from a low-voltage generator, shown in fig. 12, which is capable of delivering up to a normal load of 750 A. Current is conveyed to ring-main systems of $\frac{3}{4}$ in. thick solid copper rods, to which the vats are connected, each vat having an ammeter and rheostat, so that the current values can be regulated properly, based upon the total superficial area of the articles being plated.

Automatic polishing apparatus is employed for certain grades of finishing, where difficulty is experienced by hand work in maintaining equal pressure and definitely constant speed movements of the article, this being most essential if a first-grade finish is to be attained.

All tools are made within the works, and fig. 2 shows the well-equipped machine section of the tool room, comprising lathes, milling, shaping and drilling machines and precision grinding apparatus, each playing its part in the production of the all-important tools that must be so carefully designed and constructed when accurate products have to be produced in bulk. The power drive for the tool room is by means of two of the interchangeable 25-h.p. motors previously described, fig. 12, driving $2\frac{1}{2}$-in. diameter shafting at 250 r.p.m. Compressed air for the heat-treatment annex is supplied by a blower driven from the main line shafting, the heat-treatment section being devoted to recuperative tool steel annealing, and the hardening and tempering of tools, a gas heated muffle being employed for the purpose, reaching the high temperatures required for the treatment of the high-speed and other special steels employed, the temperature being determined and controlled by thermo-electric pyrometers.

A well equipped cabinet shop for the production of distribution-board cases, and so on, is now in full swing, and automatic turning lathes, moulding, planing, and surface grinding apparatus are turning out what may be called first-class examples of the wood-workers' art. The same care and attention to detail that is exercised in the manufacture of "Crabtree" accessories is also apparent in the ironclad switchgear shop, where every facility for the manufacture of high-grade products upon the most modern manufacturing lines exist. Batteries of multi-spindle drilling machines are employed for the economic jig drilling of huge quantities of grey-iron castings, which are conveniently conveyed by means of roller conveyors to the sections concerned, each product after and during assembly undergoing electrical and mechanical efficiency tests to ensure a trouble-free product.

The inspection department is an interesting section, as here all the work previously carried out is carefully scrutinised, and any necessary final adjustments are made. Every screw is again tested, and every nut is again tightened. After a sequence of such tests each switch again withstands a 1,000-volt insulation test, and unless the insulation is greater than 1,000 megohms it is rejected.

There is a healthy sports club, cricket, football, net ball, tennis, and bowls being played. Several prizes are played for during the season, and the cups won are the pride of the individual departments. Not only is leisure provided for, but even ill-health. This often anxious and somewhat expensive time is met by a fund which is partly contributed by the employés.

In case of accident, an ambulance and rest room is provided, fully equipped for dealing with the minor accidents that are always likely to occur in a factory, a competent nurse being always in attendance.

In conclusion, we are indebted to Messrs. J. A. Crabtree & Co., Ltd., for their permission to view the works and take photographs, and to Mr. B. G. Harrison, technical manager, for his assistance in the collection of the above information.

Electricity Meter Jewels.

Some Observations which Point to the Need for further Research on Bearing Materials.

By A STATION ENGINEER.

EVERY industry hangs on something or other which is taken for granted and hardly ever talked about until some day the stresses increase and the unknowns come to the surface and demand research. For many years lubrication was just a question of a greaser with an oil pot, but duties increased, the Michell thrust bearing came into being, people began to see that Osborne Reynolds was something more than a ridiculous theoretical lunatic, and lubrication became a science worthy of expensive research. The same thing happened with steam boiler feed water and vacuum. The old engineer thought a 26-in. vacuum more than enough, and he was content if his feed water was reasonably clean, but now we use high vacua and feed water free from oxygen, and many other things which Old Bill considered fads and fancies. The electrical industry is specially open to the discovery of weaknesses. It is a thing of shreds and patches, of strings and tapes and waxes, and of items which would have made the old steam engineer jeer with contempt, but it does astonishingly well in spite of all that.

Among the "contemptibles" which mean so much to the industry are the jewels which support electricity meter pivots. Years ago makers were able to demand and obtain the finest quality of jewels, but to-day jewels are required by the million, and the quality has suffered accordingly. Synthetic jewels have come into being, not because they are wanted, but because there are not enough of the others to go round. The synthetic jewel suffers from weak spots, which render it liable to crack and to slow down the meter and reduce the revenue. The diamond jewel looks promising. It is hard, and diamonds are really plentiful; indeed, diamond mines complain that they are too plentiful. In the recent Institution of Electrical Engineers discussion* on Mr. J. L. Carr's meter paper, Mr. C. H. W. Gerhardi stated that he had used diamonds for fifteen years and had not found one defective jewel or pivot out of thousands in use. This is a very important statement, on which one would like to hear opinions from other authorities. Some people may object to the cost of diamonds, but what does that matter when the meter is measuring electricity worth, say, £100 a year, or much more? On the one hand, Mr. Gerhardi stated that some pivots bearing 25 gramme rotors had made as many as 300 million revolutions on their diamonds and were apparently as perfect as at the start. On the other hand, Mr. E. Fawssett stated at Newcastle-on-Tyne that he had found diamonds brittle and that the surface flaked off and destroyed the pivot. There may be a reason for this: diamonds are crystalline; indeed, in the course of manufacture a large stone is actually split up, as one might split a slate, and it is possible that the suitability of a diamond when used

* I.E.E. *Journal*. Vol. 67. No. 391, July, 1929.

as a bearing in a meter may vary according to the way in which it is cut. The problem requires clearing up, as, if suitable, diamonds should do much to solve the meter problem.

The pressure per square inch on a pivot is prodigious, amounting to from 40 to 50 tons per square inch. The odd thing is that mercury meters, in which the weight of the rotor is partly borne by the mercury, suffer quite as much jewel wear as others. Much work has been done on ball bearings for meters, the rotor being carried by a steel ball instead of by a pivot, but experience does not appear to favour them. Perhaps the reason may be seen from the diagram: the ball is shown in a cupped jewel and it would seem that the bearing surface is not a point contact, but that appreciable areas are in contact. If this is the case, there will be a difference between the friction near the centre and that further away from the centre of the support, which will produce uneven wear. After a time the skin will wear off the steel ball and then it will get out of shape, after which deterioration will be rapid. There is great discussion as to the desirability of lubrication, but on the whole opinion seems to be against it. If the oil becomes sticky, it will have a bad effect; a dry bearing appears to be better.

Fig. 1.—Meter Ball Bearing.

Testing by running meters millions of revolutions is not very satisfactory. We have to remember two things, friction and stiction. Stiction acts when surfaces are in contact without movement, when they tend to weld together. When movement begins the molecules at the surface are torn off and in time the surface is damaged. A pivot that is always running may suffer less wear and tear than one run an hour or so each day. Even stationary pivots are not free from wear in a.c. meters, as the rotor is always vibrating, and cases have been recorded in which jewels have cracked when the meter was kept alive on the shunt coils, although not turning round. A further important point which requires attention is the coefficient of friction between the two surfaces in contact. The experiment has been made of using one jewel for the cup and another for the pivot; great results were expected, but not realised. One has only to try rubbing one piece of smooth glass on another to see that good results should not be expected from so doing, as the friction between glass and glass—and presumably between jewel and jewel—is very great. It is probable that work along these lines might disclose the fact that the coefficient between some kind of jewel and some alloy of metal is particularly low, and that such a combination might prove to be the solution of the problem. One has only to refer to the work of motor-car engineers with cylinders and pistons to see how important is the problem of friction coefficient. More hardness is not enough where surfaces are rubbing against each other.

The subject requires microscopic research, microscopic in the literal as well as in the figurative sense. It is well to remember that while the effects are microscopic to the research man, they are megascopic to the Accountancy Department! Research work needs money. Some generous buyers think that all research should be paid for by manufacturers, but after all it is the buyer of meters who wants accuracy far more than the manufacturer. Let users pay up like good engineers and like good commercial men. Research is not an expense, but a method of making money.

Flaxman Telephone Exchange.

Brief descriptive details of the automatic switching equipment installed in London by the General Electric Co., Ltd., for the Post Office telephone authorities.

THE opening of the Flaxman telephone exchange marks another step towards the completion of the London director automatic telephone system. It is one of the few fully equipped 10,000-line automatic exchanges so far installed in the London area, and serves the Chelsea district.

The equipment is installed in a large four-storied basement building in Mallord Street, the pleasing appearance of which bears witness to the real efforts of the officials of the British Post Office to preserve the amenities of the district by choosing a style of architecture which will harmonise with the existing houses. The basement of the building is used for stores, &c., and the ground floor contains the offices of the various officials responsible for the operation of the exchange. The first, second, and third floors, having a total area of over 18,000 sq. ft., are devoted to the exchange equipment.

The latter includes 9,900 subscribers' line circuits and 1,294 final selectors, mounted on 99 line units and one p.b.x. rack. In addition to the 822 first numerical and 640 second numerical selectors (fig. 2) for handling the local and incoming traffic, the exchange is equipped with 664 first code selectors and A digit switch finders, 405 second code selectors, 84 A digit switches, and 180 directors for dealing with calls local and outgoing to other exchanges on the system. An interesting feature of the Flaxman exchange is the use of selectors having

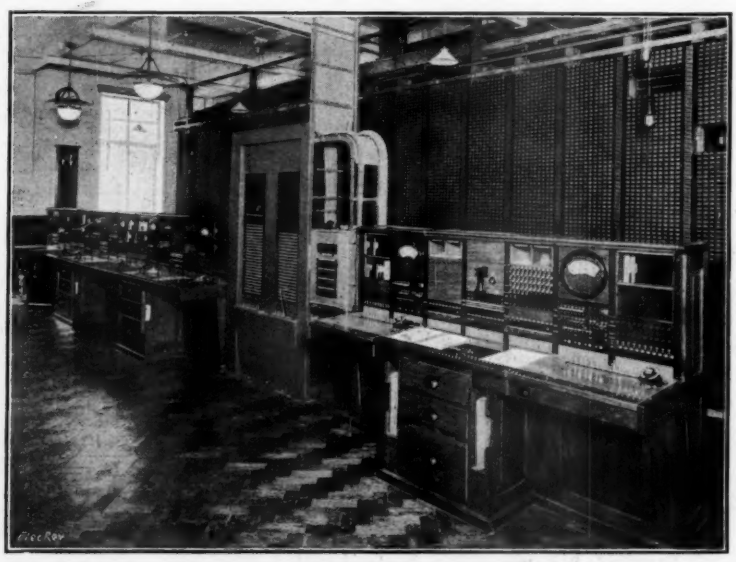


Fig. 1.—Test Desk and Meter Rack.

twenty outlets on each level, which, in addition to reducing the number of switches required, enables a better grade of service to be given, as each call has access to twenty switches in the next rank. Switches of this type are used practically throughout the equipment.

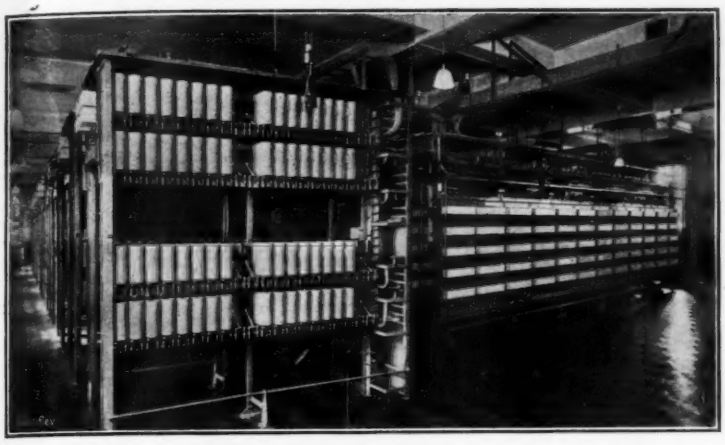


Fig. 2.—Second Numerical Selectors and Line Units.

Fig. 3.—Manual "A" Switchboard.

A number of routine testers, or "routiners" as they are termed (fig. 5), are provided for applying tests automatically to each of the main pieces of apparatus in turn, thus ensuring that they are maintained in good working order and that the possibility of breakdown in service due to mechanical or electrical faults is reduced to a minimum.

In addition to the automatic switching equipment, two manual switchboards (figs. 3 and 4) have been installed on the third floor for dealing with inquiries and calls for which a special fee is charged, and for handling incoming traffic from manual exchanges. Such incoming traffic is received over 400 incoming junctions on a suite of cordless B positions (fig. 4) and is transferred by the operators to the automatic subscribers through key-sender equipment. Calls outgoing from the Flaxman exchange to manual exchanges have access to 404 junctions; 30 coders are provided to store the calls until an operator is ready, and to convert the digits dialled into special impulses to operate the equipment at the manual exchanges.

Fig. 4.—Cordless "B" Switchboard.

The power for operating the switching and speaking circuits of the exchange is derived from duplicate D.P. batteries housed on the first floor, which are charged by motor-generator sets installed in the first-floor apparatus room. The charging motor-generator sets are run off the 400-V d.c. mains and have a full load rating of 42 kW with a regulation of 50-57 volts. The current for ringing and signalling tones is provided by duplicate ringing machines, each having an output of 2 amperes at 75 volts; one set is driven by the battery and the other off the mains.

To ensure rapid clearing of faults and therefore continuity of service, a remarkably complete alarm equipment has been installed, which, by means of a system of coloured lamp signals, informs the maintenance engineer of a fault as soon as it develops and enables him to locate it with the least possible loss of time. Besides the lamp signals, which are primarily intended to facilitate fault location, audible bell signals are given when the fault occurs, and arrangements have been made to extend these signals to all other floors, so that the man on duty can be called from any part of the exchange to attend to them without delay.

An eight-position test desk (fig. 1) of the most modern design has been fitted, from which all subscribers' lines can be tested, and facilities are provided to enable the test clerk to get into communication with any subscriber on the exchange.

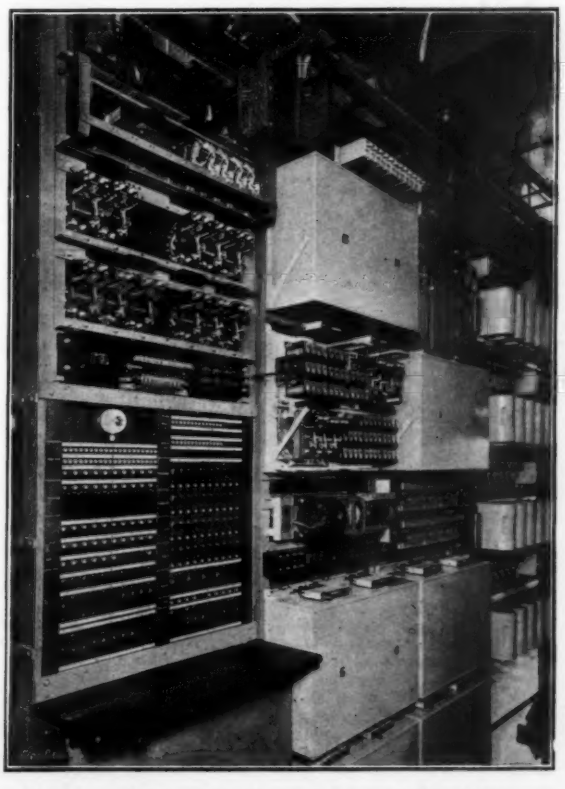


Fig. 5.—Key-sender Apparatus and Routiners.

The whole of the Flaxman exchange equipment was manufactured and installed by the telephone works of the General Electric Co., Ltd., at Coventry, Warwickshire, the exchange having been opened for public service on September 14th. The cut-over was carried through without interference with normal service, or inconvenience to subscribers, and it is felt that those subscribers who are connected to the Flaxman exchange can look forward with complete confidence to really efficient service in the future.

20-kV Underground Transmission System of Crown Mines, Ltd.

Extracts from a Paper Read before the South African Institute of Electrical Engineers.

By W. ELSDON-DEW, M.Inst.C.E., M.I.E.E., Fel.A.I.E.E., and H. DENEHY, M.I.E.E., Assoc.A.I.E.E.

THE system described is an innovation in electrical engineering, of which, we consider, South Africa can claim to be the pioneer.

The subject of electrical transmission of energy underground in mines by means of super-voltage cables has been under discussion by the Engineering Department of the Central Mining and Investment Corporation, Ltd., for several years, mainly on the score of economy and line regulation. The matter was taken up with cable manufacturers, who, except in one or two instances, were not prepared, at that time, to put up a proposition to cope with the difficulties inseparable from the unique

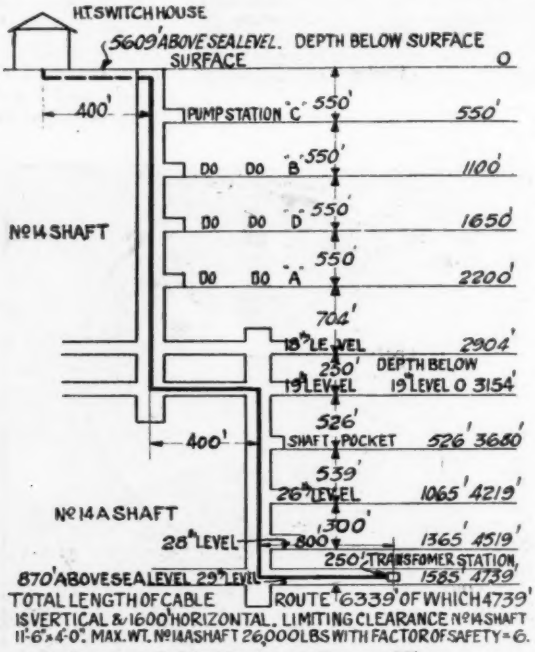


Fig. 1.—Cable Route at Crown Mines.

method of transmitting electricity at super-voltage by means of cables suspended in a vertical direction for distances of several thousand feet, and the matter was held in abeyance until two years ago.

In the interim, super-voltage transmission by cables had gained ground in Europe—it is the object of this present paper to describe our special conditions and to show the admirable manner in which they were met by the manufacturers.

The voltages that were adopted in 1909 for the various distribution services of the mines, *viz.*, 2,000 and 500 volts, were a distinct advance on the voltages previously in use in local mining work, but, in view of the greater depths at which mining is being carried on, the increasing use of electrical power for all purposes, and the greater distances involved, the use of higher voltages has had continued attention. It has only been possible lately, however, seriously to recommend the application of a definitely higher voltage (*e.g.*, 20,000 volts), as the advance in the art of manufacture of cables of this voltage for vertical shafts has not until lately been proved, either from the point of view of economy or of reliability.

The cable route at Crown Mines is shown diagrammatically in fig. 1, but the actual length of cable is 7,400 ft. (approximately) from the switch house at the surface to the transformer station on the 29th level.

Theoretically, it may be shown that for a given percentage loss in a cable of given sectional area, the power that may be transmitted is proportional to the square of the applied voltage. In practice, owing to fixed temperature limits, it may be said, roughly, that for a given actual loss the power transmitted by a cable of given sectional area is directly proportional to the applied voltage.

Temperature limits and line regulation, in the case of a 2,000-volt supply would have necessitated an ultimate expenditure in cables, spread over a period of years, of about 25 per cent. in excess of the cost of cables and transformers actually installed. The line regulation in the two cases would be approximately the same, but the full load overall efficiency works out to some 3 per cent. in favour of the higher voltage.

The prevalent cause of super-voltage cable breakdown under normal working conditions is ionisation. Ionisation is the result of the presence of voids, moisture, occluded gas or air in the dielectric or in the filling materials between the cores, and may be due to several causes, some of which are bubbles between the layers of paper, loosely wrapped or creased papers, insufficient or improper impregnation, and impregnating compound unsuitable for the particular service required of the cable. For cables laid horizontally, 20 kV, as we know, is now regarded as quite a low voltage, but a different view must be taken when the cable is suspended vertically, as the possibility of movement of the impregnating fluids, due to hydrostatic pressure and the consequent formation of voids must be taken into consideration. It is obvious that the drained type of cable, such as we use for shaft work and for normal voltages, would be quite unsuitable for the pressure under consideration.

The drained cable is so named because all free impregnating fluid is drained from the dielectric after the impregnating process (which aims at filling the papers and interstices to the utmost possible extent) but before the lead sheathing operation. It follows, therefore, that the impregnating fluid drained out can only be replaced by air, which, for reasons already given, at once debars this type of cable for super-voltage service.

The behaviour of paper cable dielectrics under certain conditions is as follows:—

(*a*) The dielectric power factor of a given cable is sensibly constant up to a certain applied voltage, beyond which it increases with the voltage—the temperature being maintained constant. This increase in power factor is the result of ionisation or the breakdown of minute particles of occluded gases, &c., in the paper interstices or fillings, and in consequence the dielectric conductance increases.

(*b*) The voltage being maintained constant, the power factor at first decreases (to a minimum value at about 100 deg. F. for a periodicity of 50 cycles) and then increases with an increase in temperature, the pressure being maintained constant.

Reference should be made to an I.E.E. paper by Dunsheath,* in which he applies Maxwell's theory of absorption as a possible explanation.

(*c*) If a cable is heated and then allowed to cool, it is found that the power factor usually has higher values at corresponding points of pressure and temperature than it had before heating.

Mechanical distortion, in one form or another, has been advanced by some as the reason for this characteristic: dilation of the lead sheath resulting in permanent deformation, separation of the cores, minute separation of the papers and consequent enlargement of voids and so on, but the subject matter is a very controversial one, and reference to a recent series of articles (Electrical Review, January 18h, 25th and February 1st, 1929) by Beaver discounts the usually accepted dilation theory.

* See Elec. Rev., November 13th, 1925, p. 774.

It should be clear that the desirability of employing super-voltage cables for this system devolved pre-eminently on the insulating qualities of the cable for the peculiar conditions of service.

Though it is not universally accepted that functions of the dielectric losses are a criterion of the excellence of the cable or an indication of the permanence of electrical and physical stability, we are definitely of opinion that, had we not made use of the three valuable characteristics briefly described above in our specification, we should not have been in a position confidently to adjudicate on the merits and demerits of the excellent tenders received: the decision was in favour of a three-core belted cable.

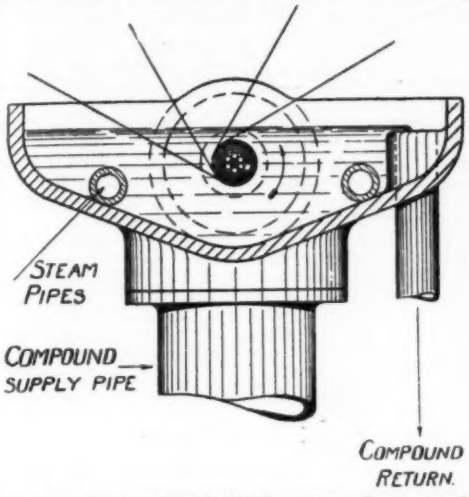


Fig. 2.—Assembly of Cable under Compound.

The specification called for a large percentage of the cable lengths to be tested as in (*a*) over a range of voltage from 13 to 26 kV; the power factor at the higher limit was specified not to exceed 2 per cent., and its increase over the whole range not to exceed 0.5 per cent. The successful tenderer increased the stringency of this test by guaranteeing the latter figure at 0.2 per cent.

The characteristics under (*b*) were specified not to exceed 2 per cent. over the whole range of temperature up to the working temperature (of 120 deg. F.).

The final of these power factor tests (*c*) was specified to be carried out after cooling as in (*a*) on all lengths previously heated for test (*b*) and compared with the results of the first power factor/voltage test (*a*).

The difference in power factor had not to exceed 2 per cent.

The stringency of this test was increased at the suggestion of the successful tenderers by maintaining the temperature of test (*b*) at 120 deg. F. for two hours.

These tests were carried out on 40 per cent. of the cable lengths, and came well within the guarantees.

As the time factor enters largely into the question of break-down under pressure, the modern trend of opinion is against raising the test pressure inordinately, and though the specification called for an excess pressure test of 40 kV on all lengths for one hour, the manufacturers put forward the alternative of 60 kV for 15 minutes, which was accepted and successfully applied.

It was also specified that a break-down pressure test should be applied to the sample used for the bending test (the latter to be carried out in accordance with the B.E.S.A. Specification No. 7 of 1926), and that the sample should withstand 80 kV for 15 minutes, after which the pressure was to be raised to the destructive point and the rupturing voltage submitted.

The manufacturers elected to increase the stringency of this by subjecting a sample to this test from one of the lengths previously heated for the power factor/temperature test, and at the same time guaranteed a sample previously heated as above, but not subjected to the bending test, to withstand a pressure of 100 kV for 15 minutes. These two tests were successfully carried out, the break-down pressures being 128 and 149 kV, respectively.

The collaboration of cable manufacturers was solicited in the specification to offer suggestions. Messrs. Glover & Co. made the following recommendation, which was accordingly embodied in the order:—

> "A sample of cable, two yards in length and in its lead-covered state, shall be subjected to the following tests for bleeding:—
>
> "The length shall be suspended vertically and then heated by means of a current of 200 amperes (a.c.) passed through each of the conductors while the lead sheathing is maintained at a temperature of 100 deg. F., either by means of suitable lagging or by enclosure in a heated vessel. . . .
>
> "The total amount of compound which shall bleed from the cable when it has been continuously maintained under the above conditions for seven days shall be less than three grammes."

The amount of bleeding was reported by the inspecting engineers to be negligible. (It is to be noted that the amount of bleeding in a similar cable supplied for a local mine by the same firm and tested similarly was absolutely nil.)

Also, at the instigation of the manufacturers, all cables in their lead-covered state were subjected to a hydraulic pressure test of 60 pounds per sq. in. by being completely immersed in a hydraulic pressure tank.

Cable manufacturers were required to guarantee the continuous and successful operation of the system for a period of five years from the date of satisfactory pressure test *in situ*.

Mr. C. J. Beaver gives the following information on his prior-impregnation method:—

The primary difference between the Glover method of making impregnated paper cables and the common vacuum *en masse* method is, and has always been, that in the Glover process the paper is impregnated in sheet form prior to its application to the conductors instead of *en masse* as in the post impregnating process. This not only ensures that every part of the dielectric has exactly the same treatment, but also gives the advantage, which is fundamentally important for the purpose under review, that the impregnation process is unfettered by any viscosity limits of the impregnating medium. The single sheet of paper passing through the impregnating machine receives a preliminary drying, and then passes through molten compound at a definite rate, *i.e.*, providing a definite time of exposure to the air and moisture expelling action of the hot compound.

Following the production of the perfectly impregnated dielectric material, it remains to assemble it in the necessary laminated form upon and around the conductors in such a manner that no ionisable matter is occluded in the ultimate mass. Assuming that air and gases are excluded from the material as a result of the method of preparation above referred to, the proposition that occlusion of air is preventable by assembly out of contact with air (*e.g.*, under hot compound) leaves little scope for argument.

In assembly the cable rotates on its own axis at a suitable rate while travelling laterally through the trough of compound, causing the strips of previously impregnated paper to be accurately wound upon it. It will be seen from fig. 2 that the strips pass through an appreciable depth of compound before reaching the cable, and that the whole area of assembly is completely excluded from air, so that the only matter which can be entrained in the lappings is a thin film of the compound, the thickness of which is dependent on the viscosity of the compound at the trough temperature and the tension applied to the paper strips; and, as these conditions are closely constant, the film is correspondingly uniform throughout both the length and the radial thickness of the insulation. The actual thickness of the film is of capillary order, but is sufficient to allow the necessary amount of movement of the papers over one another when the cable is bent.

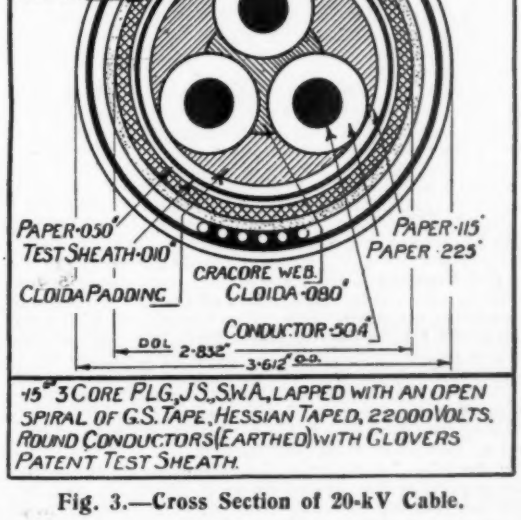


Fig. 3.—Cross Section of 20-kV Cable.

The physical conditions in the dielectric proper resulting from the above described impregnating and assembly processes are as follows:—

(1) In every part of the paper itself there is an uniform filling of compound which is solid at normal temperatures and highly viscous at the maximum working temperature of the cable.

(2) All interstitial spaces in the dielectric, *i.e.*, between the layers of impregnated paper, and between the edges of their convolutions, are filled and sealed by the entrained compound, which, being in the form of thin films, is to a large extent held in place by capillary forces, apart from the viscosity of the material.

As the result of these conditions, it is ensured that:—

(*a*) The electrical stability of the dielectric under high values of electric stress is a maximum, because of the elimination of ionisable matter.

(*b*) Under an infinity of heating and cooling cycles, representing working conditions, physical stability is maintained, *i.e.*, no bleeding or draining of free compound can occur.

It is not, I think, well appreciated that such bleeding as occurs in a cable under the drainage test is almost entirely *via* the interstices of the stranded conductors and the padding spaces.

The ordinary paper string or compressed paper strips used to fill these spaces constitute a series of laterial tubes or channels, which, compared with the laminated dielectric, may also be regarded as fairly free paths, especially when the cable is vertical.

In our cable, these drawbacks are entirely obviated by filling the strand interstices with a plastic compound which cannot by liquefied by heat, and therefore cannot flow from its original position. It is applied over each layer of wires during the stranding operations, and the succeeding layer strongly compresses it into the underlying layer, and also receives the surplus exuding outwards.

The assembly of cores and padding strips is performed under hot compound, and from the point of convergence of the component parts, the cable passes on to receive its overall lappings under the same air-excluding conditions as the core insulation.

Finally, the lead sheath is also applied under air-free conditions. That is to say, there is a supply of compound fed to the cable, and the clearance annulus is filled; whereas, in the ordinary process, the tendency is for the impregnating compound to be drained out of the insulation by the heat of the lead press box, and the annulus to contain an appreciable amount of air and gas.

Surveying the cross section of the cable (fig. 3) up to the lead sheathed stage, we have:—

(*a*) Conductors with interstitial spaces filled with non-meltable compound.

(*b*) Core dielectrics free from ionisable gases and having all spaces between laminæ, &c., filled with films of compound, the conditions as a whole being such that physical (and, consequently, electrical) stability is ensured under all working conditions of the cable.

(*c*) Non-fibrous, resilient fillings which can neither themselves move in relation to, nor permit gradual drainage from adjacent paper surfaces.

(*d*) Overall or belt insulation having the same properties and characteristics as the core dielectrics (*b*).

(*e*) The clearance space between the outer surface of the dielectric and the inner surface of the lead sheath completely filled with a film of viscous compound.

Each cable is made up of eleven individual lengths, the longest of which are in the vertical in No. 14 shaft, and consist of two lengths (for each cable system) of 1,150 ft. each.

During jointing operations, which occupied from 10 to 12 hours per joint, temperature and relative humidity figures were taken. The maximum figures obtained were at the first shaft pocket in No. 14a shaft, *viz.*, 110 deg. F. and 89 per cent. The average values for these figures were 80 deg. F. and 82 per cent. relative humidity.

When the joint is completed, prior to pouring, the joint box lid is bolted on and the desiccator is applied. The desiccator consists of a petrol-engine driven air pump, which pumps air at a few pounds above atmospheric pressure through a series of four vessels containing a calcium-chloride drier in trays, thence by a hose and connection to the sealed joint box, whence it exhausts to atmosphere by a pet cock screwed into the box for the purpose. The period for desiccating was varied from half to one hour, according to the humidity.

As most of the joint boxes contain over 200 pounds of compound, and bearing in mind the extreme importance of avoiding, as far as possible, the occlusion of gases in the compound during filling operations, this boiler is equipped with a hand pump for circulating the compound during the heating period, and later, by the manipulation of valves, for the filling process, the compound being piped to the boxes. The compound is heated by a paraffin burner to about 10 deg. F. higher than the pouring temperature of 320 deg. F.; the break-down voltage of the compound is 55 kV for the B.E.S.A. oil-testing gap, *i.e.*, 150 mils between ½-in. spheres.

For the inbye joints it was necessary to retain the boiler in the cage and pipe the compound through piping as long as 24 ft. to the boxes, in which case it was necessary to heat the pipes with blow lamps before pouring.

After the joint boxes had been sealed up and allowed to cool off for a period not less than seven days, they were opened up and topped; the shrinkage was found to vary between 1¾ in. to 3 in. In spite of these elaborate precautions, air holes showed up in one or two cases; these were carefully heated with blow lamps and melted compound allowed to fill in, after which they were topped.

The installation was carried out under the supervision of Mr. Winstanley, the contractor's cable engineer; the jointing was also done under the supervision of this gentleman by the contractor's jointer; it was one of the conditions of the contract that the mine cable jointers should be initiated into all the phases of super-voltage jointing.

Reviews.

Stores Accounts and Stores Control. By J. H. Burton, A.S.A.A. Pp. ix+144; forms and rulings. London: Sir Isaac Pitman & Sons, Ltd. Price 5s. net.

Industrial Storekeeping, Accounting and Perpetual Inventory. By C. Hanneford-Smith, F.C.W.A.; foreword by Sir John Corcoran, K.B.E., C.B. Pp. x+114, illustrated. London: Gee & Co. (Publishers), Ltd. Price 8s. net.

Who can disagree with Mr. Burton, when, in his preface, he writes "From a theoretical point of view the keeping of Stores Accounts is so simple . . ." or fail to agree that in practice the simplicity vanishes?

Those opening words of wisdom must be the basis of test of the value of these two books.

Again, in the same preface, the author gives prominence to the need for a substantial return in the way of reduction of expenses from what may be the heavy expense of installing and maintaining the correct system for any business.

This is the criterion of success for the organiser, whether it be in the organisation of stores control, or of any other system introduced into an industrial or commercial establishment.

Let us then see in how far these two books attain the standards set; whether they give advice or guidance of a practical nature, and whether there is any indication of the economies that should obtain when their suggested methods are adopted.

To do so we must first summarise the field surveyed by each of them; perchance the fact that they are both reviewed at the one sitting may be of help to those in search of assistance in this important sphere.

Mr. Burton, after dealing with the theory and practice of stores accounting, goes on to the consideration, first, of all of personnel, and, secondly, of the stores itself. The former, as in all matters of organisation, is the first essential factor—getting hold of the right man for the job and then using his abilities to best advantage.

"Where should the stores ledger be kept?" is a question that needs to be answered, for it is of greater importance than may, at first glance, appear. Mr. Burton rightly says that it depends on the circumstances, and then gives some sound advice. There follow some practical problems in Chapter V; problems relating to the checking of weights, empties and packages, the treatment of carriage and overhead charges, that very vexed question of pricing out, wastage and shortage, and amongst many others, the setting of maximum and minimum stock, and of ordering levels, upon which subject the author in common with every other author so far, gives merely a few fragmentary notes. The point is mentioned in at least three places in the book, and we are told there are many factors to consider. We know it too well, but what we and every student want to know is exactly how you do it in particular cases. Tell us all about the conditions and what you did in order to fix your limits, and we will thank you more for that, than for many pages for generalisation. The fact is people are frightened about it. So much depends upon the correct setting of limits as to whether you have, on the one hand, too much capital locked up in your stores, and, on the other, whether you have the goods there when they are required. This book would be twice the value if it only showed us how to do it.

Chapter VI deals with the relation between the stores and the other administrative departments, and includes a useful summary of the advantages and disadvantages of central purchasing and stores stocktaking, the stores accounting system and the forms necessary to work it, of which there are over twenty illustrated; auditing and the use of office machinery occupy the following chapters. In the machinery chapter a fairly comprehensive survey is made of modern appliances, without some or all of which stores control cannot be performed with both speed and precision. The Hollerith and powers systems are described as completely as need be in a text book. The Burroughs, Sundstrand, Elliot-Fisher, and Remington machine ledger posting systems are given less space than they deserve, and we scarcely think that sufficient prominence is given to the Kardex and similar stores ledgers, in which signalling the state of the stock is such a valuable feature. The Paramount and D.P. methods are commented upon. We are pleased to see that nearly one-third of the book is devoted to these modern appliances, but regret very much that the author has left so much to description, whereas a photograph showing details of the appliance is much more interesting and easy to follow. Will he be so good as to include them in the second edition into which we hope the book will eventually pass? From our experience, however, we are quite sure that the makers of the machines will be only too glad to supply the inquirer with what their sales staff so persistently refer to as "literature." But, oh student, if you do get hold of any of this so-called "literature," use heaps of salt to get the right flavour into the makers' accounts of the marvellous feats the machines will perform—apparently, almost without human aid!

The final chapter is allowed only four pages. Its subject is "Stores Control." In a way it is a summary of control methods advocated in previous chapters, but as a chapter on stores control it is woefully inadequate and a severe anti-climax to a book that, as a description of methods of accounting and of the way to overcome practical difficulties, has much to commend it.

In fact that second edition, with a few such amendments as we have presumed to suggest, should be a leading authority on the whole subject. Two pleasant features are the price, and the author's clear style of writing. The appearance of being a collection of papers which the author has written, perchance for the learned societies of which he is a distinguished member, does not really mar the continuity of the narrative.

In a way Mr. Hanneford-Smith has followed the general plan adopted by Mr. Burton, but his book requires a little more unravelling. There is no list of sub-headings of chapters, nor are the sub-headings themselves clearly set out. On the other hand, he gives a list of forms, accounts, &c., which is most valuable for reference. There are twenty-three forms and ten photographs of appliances, &c.

One of his good points is that he illustrates some of the forms with figures, which make their use so much more readily grasped. And, again, the illustrations of Kardex and other visible record index appliances are very clear and of help in giving some idea of their use.

Chapter VI is headed "Modern Methods of Recording Stocks" and takes up twenty-two pages. In it are described the Bizada, Costmeter, Kardex, and Roneodex visible record systems. He might just as well have described one of them, perhaps at greater length. The inclusion of four, all on similar lines, to the exclusion of the Hollerith, Remington, and other machines is a fault which cannot be overlooked. The omission very considerably reduces the value of the whole book. In certain circumstances a hand-written visible index may be the best method, we agree, but in others the use of machinery is certainly necessary if economical storekeeping records are to be maintained, and in very large concerns the Hollerith and Powers machines may be the most efficient and economical. At any rate, the inquirer should be told that such machines are available.

The author might well have made his title "Some Notes on Certain Problems in Stores Accounting and Control," and then the prospective reader would have been warned to look first to see if the particular problem upon which he wanted some advice or experience was mentioned. But, with such a title, the price of the book would no doubt have had to be lower.

What is needed in a general text book (and the titles of these two books lead one to suppose that that was their authors' purpose) is a well-written continuous narrative, fully indexed and sub-headed, treating all sides of the subject, and, in the absence of lengthy description, reference to where such treatises may be found; an ample sprinkling of practical cases, and, where figures are concerned, plenty of them to make their meaning clear; illustrations of any appliances or machinery cited; and, most important of all, a statement of the theoretical aspect of each point, with a *résumé* of practical difficulties encountered in employing the theory, together with examples of exactly how the difficulties have been overcome. If a committee were appointed to draft the general conditions governing the writing of text books, they would include these and several others. Perhaps they would want to examine the would-be authors too, and that might not be a bad step to take. Then, provided the author had the experience worth writing about and would fulfil the conditions, the student or engineer would at last be sure of knowing how to find what he required, and would take some little pleasure in doing so. Is it too much to hope for such a state of affairs? Really, the modern advances in methods of organisation should spread to the writing of text books. If that happens, the reviewer's lot will be a happier one!

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

The E.T.B.I. Competition.

The Secretary of the Electrical Trades Benevolent Institution (Capt. J. T. Keeping, M.C.) has sent us the solution to the problems set in the Institution's competition. It will perhaps be remembered that the names of 16 towns were given in a cryptic manner and that the problem was to identify the towns and give the shortest length of cable necessary to connect all the towns together, starting and ending at the G.P.O., London.

The towns were:—Coventry, Perth, Nottingham, Yarmouth, Portsmouth, Sheffield, Luton, Liverpool, Brighton, Manchester, Oxford, Exeter, Bath, Doncaster, Cambridge, and King's Lynn. The length of cable required was 1,496.5 miles. All competitors who correctly "spotted" the towns are asked to send in a claim on a postcard, to the Secretary at 9, Southampton Street, Holborn, W.C.1, stating the mileage of cable entered in their solutions.

Dutch Electrical Imports and Exports.

The following table shows the value of Dutch imports and exports of electrical machinery and apparatus during the past two years:—

	Imports.		Exports.	
	1928	1927	1928	1927
	£	£	£	£
Electrical machinery ...	735,300	608,100	599,350	447,750
Radio apparatus ...	797,300	406,550	1,924,800	776,250
Telegraph and telephone material	703,050	470,850	47,200	64,000
Insulated wires & cables	660,900	835,750	346,550	290,150
Dust collectors, electric	268,500	208,950	25,050	14,800
Filament lamps ...	73,850	84,750	2,011,500	1,641,650
Electric tramcars ...	30,600	58,300	1,750	25,500
Electric locomotives ...	8,250	13,750	56,250	—
Arc lamps	2,850	2,300	12,050	12,400
Other electrical material	697,150	608,450	267,150	235,650
Totals ...	£3,977,750	£3,297,750	£5,291,650	£3,508,150

It will be seen that radio material represents 20 per cent. of the imports, electrical machinery following with 18.5 per cent., telegraph and telephone material 17.7 per cent., and insulated wires and cables 16.7 per cent. Germany is credited with 58¼ per cent. of the imports, Great Britain being second in the list with 9.5 per cent. An analysis of the exports shows that metal-filament lamps represent 38 per cent. of the total, radio apparatus 36.4 per cent., electrical machinery 11.3 per cent., and insulated wires and cables 6.6 per cent. France is the largest customer for Dutch electric lamps. France, Germany and England are the chief buyers of Dutch radio apparatus, while Germany takes 28.8 per cent. of the Dutch exports of electrical machinery.

Plumber-Jointers' Wages.

Consequent upon the alteration of wages in the electrical contracting industry (*vide* our last issue, p. 563), the wages of plumber-jointers and plumber-jointers' mates in the Greater London area will be at the rate of 1s. 10½d. and 1s. 5.8d. per hour, respectively, as from the second pay-day in October up to and including the period covered by the last pay-day in this month.

New Italian Companies.

Among the new companies recently formed in Italy are the Società Azienda Elettrica Asolana, organised at Ascoli Piceno with a capital of 2,000,000 lire; La Società Impresa Elettrica di Illuminazione di Roccastrada, 500,000 lire; La Società Accumulatori Leggeri Pouchain, 550,000 lire; La Società Ligure Prodotti Elettro-Siderurgici Alpe, 50,000 lire; and La Società Industrie Elettro-techniche Nazionali, 120,000 lire.

Unemployment.

An increase of 15,380 in the number of unemployed is shown for the week ended September 23rd. At that date the total was 1,162,900, as compared with 1,147,519 on September 16th, and 1,295,234 on September 24th, 1928.

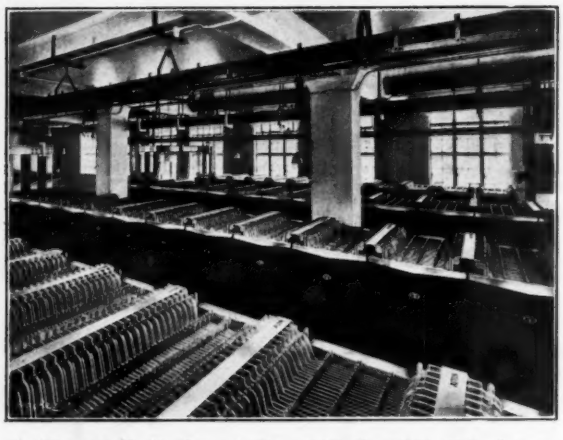
Works Visit.

About 90 members of the Ipswich Engineering Society visited the Osram Lamp Works of the General Electric Co., Ltd., at Hammersmith, on October 2nd. The party was accompanied by Mr. C. J. Robinson, secretary of the society, and Mr. F. Crush, manager of the Ipswich branch of the G.E.C. On arrival at the works the party was split up into small groups and placed under the charge of special guides. They were then conducted over various sections of the works, the guides demonstrating and explaining the different methods

of manufacturing "Osram" electric lamps and radio valves. Subsequently the Osram glass works and the G.E.C. laboratories were visited.

"Alton" Telephone Batteries.

The "National" automatic telephone exchange, one of the new 10,000-line London exchanges recently put into commission, is equipped with two "Alton" batteries (illustrated herewith), each of which has a capacity exceeding 10,200 Ah at the 10-hour rate of discharge. Both of the batteries are made up of 47-plate cells each weighing nearly 3 tons. The plates measure 20 in. by 30 in., each positive and negative weighing about 70 lb. and 45 lb., respectively. The load on modern automatic exchanges exceeds the current taken by many small towns for lighting and power purposes, and the Alton batteries



"Alton" Batteries at the "National" Telephone Exchange.

at "National" are capable of giving an output in excess of 5,000 A for one hour. The size of these batteries, which are probably the largest on telephone service in Great Britain, can be judged from the dimensions of the cells, which are nearly 4 ft. in length and height and 2 ft. 6 in. wide.

Electric Trolley 'Buses for Brazil.

The Commercial Secretary at Rio de Janeiro (Mr. S. G. Irving) reports that a syndicate in Brazil, having in view the establishment of a service of electric trolley 'buses over a distance of 150 kilometres, desires to receive literature from British manufacturers. Details of the inquiry can be obtained by interested British manufacturers upon application to the Department of Overseas Trade, 35, Old Queen Street, S.W.1. (Reference A.X. 8616.)

Radio and the Music Trades.

A conference to discuss the relationship between the radio and music trades was held in London on October 3rd. Mr. A. E. Ball, president of the Gramophone Dealers' Association, took the chair, and in some introductory remarks said that those present were all very concerned at the serious price-cutting which was prevalent in the radio industry. Mr. J. T. Mould, chairman of the Radio Manufacturers' Association, said that price-cutting was due to the fact that the business had got into wrong hands. All kinds of undesirable people had entered the trade because there was money in it. Now, when competition was so keen, there was not so much money, and they resorted to price-cutting to attract customers. The subject had been discussed by the responsible associations of the industry, and certain plans were being formulated which he hoped would lead to better conditions. Mr. Mould then proceeded to deal with the principal subject of the conference. He said that the radio trade and the retail gramophone trade were complementary. People wanted both forms of entertainment, and it was inevitable that the radio receiver and the gramophone would be combined. Dealers in each trade would meet with handicaps when taking up the other business. The radio business required technical knowledge and "service," which could only be obtained by the employment of skilled electricians.

A discussion took place upon Mr. Mould's address. One of the main points which arose was the variation of discounts in the radio industry. Strong representations were made that there should be a standard discount throughout the trade. One speaker said that there was nowadays no difficulty in obtaining skilled men to look after radio sets, but he said that they should aim at bringing out a combined instrument which was as simple and "foolproof" as the ordinary gramophone.

British Malayan Electrical Imports.

The imports of electrical machinery and apparatus into British Malaya during last year reached a value of £1,181,150, as compared with £876,000 in 1927. Great Britain is credited with 79 per cent. of the imports, as against 10.7 per cent. to the United States.

The Marking of Imported Vacuum Cleaners.

The *Board of Trade Journal* announces that the application made for the marking of imported electric vacuum cleaners, under the Merchandise Marks Act, 1926, is not being proceeded with.

Revenue from Electrical Advertising.

An increase in annual gross revenue of $200,000,000 was recently held out as an inducement to American electric light companies to promote electrical advertising service on a broad scale. Mr. C. R. Tracy, addressing the annual convention of the Illuminating Engineering Society, which was held at Philadelphia, gave the foregoing amount as a conservative estimate of the added revenue which the companies might derive from the sale of energy to operate "electrified salesmen." Mr. Tracy said that electrical advertising should be promoted by the companies as a load-building operation. Many companies had failed to recognise the value of this type of load. As a general rule, energy sold for electrical advertising constituted a long-hour, high-rate load, going on existing lines and one which required the minimum of additional meter and transformer equipment. The speaker emphasised the importance of proper sign maintenance, which included the replacement of burned-out lamps, painting and varnishing signs, weekly inspection, winding and setting clocks, and display changes. The cost of maintenance was more than offset by the added revenue received as a result of the added care.

Polish Electrical Imports.

According to a recent report, the value of the electrical machinery and apparatus imported into Poland during last year amounted to £2,883,850, as compared with £2,164,550 in 1927. The trade is largely in German hands, that country being credited with 55 per cent. of the imports, the remainder being divided, in the following order, between Sweden, Austria, Holland, Switzerland, France, Czecho-Slovakia, Hungary, Belgium, and Great Britain, the British share, however, being only 1.1 per cent.

Nicaraguan Electrical Imports.

During 1928 the Republic of Nicaragua imported electrical machinery valued at 119,940 cordobas (about £24,000), practically all of which came from the United States and Germany.

Lancashire-Crypto Extensions at Willesden.

The Crypto Electrical Co., which recently acquired the business of the Langham Gears of Slough, has now completed the equipment of a new factory adjoining its present works in Acton Lane, Willesden, N.W. This extension, built expressly for the purpose of manufacturing the Langham gears, will enable the increasing demand for these geared motor units to be met. The motors will pass direct from the company's existing works to the new factory for assembly with the gear units.

Book Notices.

"Electrical Wiring and Contracting." Part I. Edited by H. Marryat, M.I.E.E.—This comprehensive work is to be published in about 30 weekly parts, commencing October 12th; price 1s. each part Included in the list of subjects to be discussed are:—"Workshop Science," "Alternating Current Work," "Mathematics," "Measuring Instruments and Testing," "Primary and Secondary Batteries," "Motor Starters and Regulators," and "Converting Plant."

"Electric Arc Welding Operators' Handbook." Pp. 38. London: Alloy Welding Processes, Ltd.—This booklet is intended for the progressive operator who wishes to keep up-to-date with the latest developments in metallic arc welding. The first section is devoted to instructions for beginners, and is followed by a description of the A.W.P. process outlining its advantages. Conditions of electrical supply plant, &c., for welding are also dealt with and types of A.W.P. electrodes for the various classes of work are included. The booklet is concluded with diagrams showing the preparation of joints and some excellent illustrated examples of welded work.

"Science Abstracts" (A. & B.), Vol. XXXII. Part 9. September 25th, 1929. London: E. & F. N. Spon, Ltd. Price 3s.

"Overhead Power Lines," by W. Morecombe. Pp. xi+236; illustrated. London: Chapman & Hall, Ltd. Price 15s. net.

"The Book of Electrical Wonders," by E. Hawks. Pp. 316; illustrated. London: G. C. Harrap & Co., Ltd. Price 7s. 6d. net.

New Spanish Company.

It is reported from Madrid that under the auspices of several French concerns, including the Société Générale de Constructions Electriques et Mécaniques "Alsthom," the International General Electric Co., and the Sociedad Iberica de Construcciones Electricas, negotiations are in progress relative to the formation of a new company to establish large electrical engineering works in Spain.

German Electrical Imports and Exports.

A return just issued shows that the imports of electrical machinery, cables and electrical fittings and accessories into Germany during the seven months ended with July last, attained a value of £1,525,100, as compared with £1,255,850 in the corresponding seven months of 1928. The exports of similar material from Germany during the same periods advanced from £13,289,200 to £15,817,600.

United States Electrical Exports.

During July last the value of electrical machinery and equipment exported from the United States was $12,891,948 (against $9,919,988 in July, 1928), bringing up the total for the first seven months of the year to $83,669,418 ($63,186,854). Among the most important increases were the following:—Radio apparatus, from $948,431 to $1,787,342; refrigeration sets up to 1-ton capacity, from $575,748 to $1,186,566; telephone apparatus, from $247,882 to $615,184; insulated copper wire and cable, from $394,373 to $504,612; stationary motors (1 to 200 h.p.), from $198,532 to $449,585; transformers (500 kVA and over), from $124,051 to $226,898; motors ½ h.p. and under, from $193,572 to $246,238; and railway signalling apparatus, from $65,904 to $170,077. There were few important decreases, the largest occurring in the case of switchboard panels (not telephone), from $258,509 to $64,485.

As usual, Canada was the United States' principal customer, taking goods valued at $3,876,794. The United Kingdom took second place with $1,002,814, and Brazil, with $903,446, was third. Other large importers of American electrical goods were Argentina ($864,472), Australia ($676,404) and Mexico ($494,183).

German Aluminium Import Duty.

The United Aluminium Works, Co., which is owned by the German Reich, has applied for the imposition of an import duty on crude aluminium, the proposal having so far been received favourably. It is considered that a Bill will be introduced for the purpose now that the consuming industries have expressed themselves in favour of the scheme, with the reservation that the amount of the duty should only be sufficient to avert the possible dumping of American material upon the German market, and not great enough to cause an increase in the price in the home market.

Large American Radio Merger.

It is reported from New York that three large radio manufacturing concerns—the Kolster, Earl and Freed-Eisemann companies—have merged their assets, valued at about $50,000,000. The Earl company already held a controlling interest in the Freed-Eisemann concern and three of its shares will be exchanged for one Kolster share. The group is said to control over 700 radio patents.

Tube Works Closed Down.

As the result of a failure of negotiations between the British Mannesmann Tube Co. and its employés on the question of a reduction in wages, the company's Landore works, near Swansea, were closed down last week.

New French Companies.

Among the new companies recently formed in France are the Société d'Etudes pour l'Amenagement des Chutes du Rhone de Valence à Mondragon, with a capital of 600,000 fr., to prepare plans for the establishment of a hydro-electric station on the River Rhone between Valence and Mondragon; and La Société Alsacienne de Véhicules Electriques, with a capital of 2,500,000 fr., to manufacture, sell and maintain electric vehicles in Alsace.

The Transfer of the Shanghai Undertaking.

Some particulars of the transfer of the Shanghai electricity undertaking from the Municipality to the Shanghai Power Co. have been sent us by Mr. T. H. U. Aldridge, who remains chief of the undertaking, with the title of vice-president and general manager. The other principal officers are:—Mr. C. S. Taylor, deputy general manager; Mr. H. Gordon Wright, secretary; and Mr. E. J. Edgar, chief engineer. As from August 9th the company assumed all the current operating and employment contracts and contracts entered into by the Council for the purchase of plant for the account of the Electricity Department, and all other obligations. The company was also authorised to collect all outstanding accounts rendered in the name of the department. The office is still at 17, Foochow Road (P.O. Box 404), Shanghai, but communications should now be addressed to the Shanghai Power Company.

Italian Lamp Production.

The output of electric lamps in Italy during April last amounted to 1,369,976, bringing up the total for the first four months of 1929 to 6,834,235 lamps, as compared with 5,491,030 in the corresponding period last year.

Social Events.

A swimming gala under the auspices of the Magnet Social Club (General Electric Co., Ltd.) was held recently at the Holborn Baths. A number of events were decided, and remarkably close finishes and times were the rule. The two main events were competitions between various G.E.C. London establishments for cups presented for team events by Mr. and Mrs. L. C. Gamage. Mrs. Gamage's cup was won by the G.E.C. Research Laboratories, who beat Magnet House, and the L. C. Gamage cup was won by Fraser and Chalmers, Erith.

The Sunco Swimming Club held its first annual gala at the Holborn Baths on September 30th, when several interesting events were contested. Principal among these were the finals for cups presented by Mr. A. G. Beaver and Mr. R. Tweedy-Smith, the former being for men and the latter for ladies. The cups were won by Miss Glover and Mr. S. Davidson. The G.E.C. team was successful in the men's team race. The prizes were presented by Mrs. R. Tweedy-Smith.

The annual bowling match of the Electrical Contractors' Association of Scotland (East *v.* West) was held on September 25th, on the bowling green attached to the Hall of the Royal Company of Archers, Edinburgh. The weather was good, and the match proved to be most enjoyable. Three rinks were played, and, as usual, the West were victorious, winning the match by two rinks to one. After the match the visitors were entertained to tea in the archery butts of the Royal Company by the Edinburgh members. By the courtesy of the Royal Company, the visitors were shown over the Hall and premises of what is known as "The King's Bodyguard," and very much appreciated the wonderful trophies and fine collection of pictures.

Criticism of the Patent Law.

In an address to the Bristol section of the Society of Chemical Industry last week, Dr. Herbert Levinstein (British Dyestuffs Corporation, Ltd.) severely criticised the existing patent laws of this country. He maintained that a very large proportion of the patents granted were applied for merely to block the development of useful inventions. If contested, most of them would be adjudged invalid, but the cost of patent litigation was so great that there was considerable hesitation in commencing an action. He said that the Association of British Chemical Manufacturers was preparing a memorandum on the subject to place before the Board of Trade Committee recently appointed to consider and report upon the existing patent law.

Glareless Lamps.

In pursuance of its campaign to inculcate in the public a preference for "pearl" and "opal" lamps over clear-glass lamps, the Electric Lamp Manufacturers' Association demonstrated the virtues of glareless lamps to a party of visitors at the London Lighting Service Bureau on October 3rd. The visitors were welcomed by Mr. W. F. Moir and Mr. W. J. Jones, and Mr. W. Barker, a past president of the British Optical Association, addressed them upon the evils of glaring illumination, particularly in industry. Mr. L. E. Buckell mentioned that glareless lamps had now been adopted by a number of the leading transport organisations, theatres, &c.

A similar meeting was held at the Grand Hotel, Birmingham, on the following day. Mr. W. J. Jones addressed the company and demonstrated the virtues of the glareless lamps, and Mr. E. J. Jennings, secretary of the Birmingham Electric Supply Department, presided at a subsequent luncheon.

The 20th Illumination Design Course.

We have received from the Electric Lamp Manufacturers' Association the programme of the 20th Illumination Design Course, which is to be held at the London Lighting Service Bureau on seven successive Monday evenings, commencing on October 21st. The subjects of the lectures will be as follows:—"The Lamp of To-Day" (Mr. L. E. Buckell); "Illumination Design" (Mr. F. Marsh); "Selling Electric Light to the Shopkeeper" (Mr. T. Catten); "Electric Lighting in Industry" (Mr. S. Anderson); "Electrical Advertising" (Mr. H. Lingard); "Architectural Lighting" (Mr. R. W. Maitland); and "Miscellaneous Lighting Problems" (Mr. W. J. Jones).

An Electric Wash-house at Wallasey.

The Manchester *Daily Dispatch* reports that Wallasey is to have one of the most up-to-date municipal wash-houses in the country with electric washers, electric drying houses, and an electric mangle. The Corporation Health Committee has decided to apply to the Government for sanction to borrow £16,500 for this purpose, and it is hoped to complete the new building in about five months. Eighteen slipper baths are included in the scheme.

New Turkish Import Duties.

A new scale of import duties on electric motors, dynamos, transformers, commutators, resistances, coils, magnetos, sparking plugs, convertors, distributors, &c., came into operation in Turkey on October 1st. Hitherto these have been dutiable at rates ranging from £19 to £37½ Turkish paper (£T1 = approximately 2s.) per 100 kg. (2 cwt.). In future such goods are to be divided into the following six classes: Up to 10 kg., £T40; 10 to 50 kg., £T12.50; 50 to 100 kg., £T7.50; 1,000 to 2,000 kg., £T6.50; 2,000 to 5,000 kg., £T5; and over 5,000 kg., £T4., the rates being all per 100 kg.

The New Zealand Radio Market.

The United States Consul at Wellington reports that in New Zealand the American electrically-operated radio receiver is rapidly displacing the battery-powered instrument, and the local market is in a decidedly unsettled state. Battery sets, of which large stocks are still held, are being marketed at practically cost, or even below cost, prices. The United States is the exclusive supplier of this new type of instrument; there are at least six makes retailing at from $170 to $1,215 for the "de luxe" cabinet models. Discounts of from 25 to 30 per cent. are the rule, from wholesaling importer to retailer, while American suppliers' prices are anywhere from 20 to 40 per cent. below landed costs. Electric sets are utilisable in practically all parts of New Zealand. The 230 voltage is universal. Some dis-

satisfaction is being expressed by local dealers over the failure of most American suppliers to furnish sets capable of direct operation on a.c. at 230 volts. In many cases a transformer must be used outside of the set proper which, while only slightly increasing its cost, results in a certain amount of inconvenience. It is thought that "salability" would be enhanced if the American manufacturer would arrange to incorporate the transformer in the body of the instrument, or supply an export model designed to work directly on 230 V.

Trade Announcements.

Messrs. Belling & Co., have appointed Messrs. Nutter, Son, & Edge, Ltd., Cromford Court, Manchester, as principal agents for the sale of their electric fires and cookers in the Lancashire, Cheshire and North Wales area. A large stock will be available.

The Cardiff branch of the Tungsram Electric Lamp Works (Great Britain), Ltd., has been removed to larger premises at 16 and 17, Hills Terrace. The telephone number is unaltered.

Bankruptcy Proceedings.

S. B. Watson, trading as S. B. Watson & Co., 73, Crouch Street, Colchester, electrical engineer and contractor.—The public examination herein was held on October 3rd at Colchester. According to the statement of affairs, there were liabilities amounting to £2,757, and a deficiency of £2,378. Debtor stated that he commenced business in February, 1927, without capital, but he had a bank overdraft of £200 guaranteed by his father. Structural alterations were carried out to his father's premises costing between £300 and £400. Debtor stated that for the year ended September, 1928, the turnover was £2,335, and there was a loss of £323. This he attributed to undertaking work at too low a price, and also one or two bad workmen. The Deputy Official Receiver stated that in addition to the £200 overdraft, guaranteed by the debtor's father, the debtor had received advances to the amount of £2,400, whilst his deficiency was nearly £2,400, which meant that since February, 1927, £5,000 had gone. The debtor was asked for an explanation, and he replied that one cause was bad workmanship, for which he received no money, and cutting prices, and he added that it cost him three times the amount he had received. The debtor was ordered to prepare cash and trading accounts, and the examination was finally adjourned.

J. L. Whiting, 4, Portland Street, Newark, electrical engineer and contractor.—The public examination herein was held on October 3rd at Nottingham, when the debtor attributed his failure to want of capital and doing work at too low a price. He returned a statement of affairs showing gross liabilities of £498, of which £491 was expected to rank, and in the assets stock amounted to 10s. It appeared that there had been a complaint by two creditors that as the debtor was making a fair profit and doing work for good customers, they could not understand why he got into debt. The debtor was closely questioned regarding his daily routine, and, after a lengthy discussion, the examination was closed.

J. Hobson, electrical engineer, 1a, Thorncliffe Grove, Whitworth Park, and Cross Street, Pendleton, Salford.—Receiving order made September 26th on debtor's own petition.

H. Cohen (E. Cohen), electrical engineer, &c., 41 & 43, The Village, Lower Bebington, Chester.—Last day for proofs for dividend, October 15th. Trustee, Mr. J. Allcorn, Government Buildings, Victoria Street, Liverpool.

F. H. Graham, electrician, 14, Hilltop Avenue, Harehills, Leeds.—Receiving order made October 1st, on debtor's own petition.

W. J. Phillis, electrical engineer, 87, Overton Road, Leicester.—Receiving order made October 2nd, on debtor's own petition.

H. E. Daft, electrical engineer, Gloucester Place, Monument Street, Peterborough.—Receiving order made October 1st, on debtor's own petition.

Company Liquidations.

A. H. Seager, Ltd., electrical and wireless engineers, Orient House, Station Road, Belmont, Surrey.—The statutory meeting of the creditors of the above was held recently at the Parish Hall, Downs Road, Belmont, when Mr. H. K. Shersby, the liquidator, reported that the ranking liabilities were £2,560. In addition, there was a fully-secured creditor for £80, who held as security a car of the estimated value of £90. The net assets were £606. The company was registered in 1927 with a capital of £1,200, and was formed to take over the assets and liabilities of a wireless and electrical engineer. It was stated that during the 18 months that the company had been in existence it had traded at a loss. During the first six months the turnover was £695, but between December 1st, 1928, and May 31st last, the sales increased to £1,414. Recently the turnover had declined. The position of the company was attributed to underestimating for a contract. It was decided that the voluntary liquidation should be continued with the present liquidator, whilst an advisory committee of the principal creditors was also nominated.

Newcastle Electrical & Motor Accessories, Ltd.—Particulars of claims by October 16th to the liquidator, Mr. I. Nixon.

Private Arrangements.

Leonard Rowbottom, wireless dealer, 20a, High Street, Stourbridge.—The creditors of the above were called together on September 25th, when Messrs. Poppleton & Appleby, accountants, of 3, Warwick Passage, Corporation Street, Birmingham, submitted a statement of affairs showing liabilities of £379, and assets of £110. It was stated that the stock consisted mainly of various units used in the making up of sets, and was bought from the sale of a stock of another firm which ceased operations. The trading figures would seem to show that the debtor had not been working at a sufficient margin of profit to cover his overhead and personal expenses. The debtor commenced trading at High Street, Brierley Hill, in 1927, with a capital of about £60 in cash, and he also had stock of the value of £30. He had previously been employed by a wireless firm in the district. He managed to work up a fair business, but finally suffered through keen competition and the cutting of prices. The debtor had been pressed by creditors, and, on the advice of his solicitor, executed a deed of assignment to Mr. F. E. Bendall, of Messrs. Poppleton & Appleby. The creditors decided that the deed should be confirmed and the estate realised.

George Arthur Hodgson & Herbert Dennis, electrical engineers, &c., trading as G. A. Hodgson & Co., Stump Cross Works, Britannia Road, Morley, Yorks.—A meeting of the creditors of the above was held recently, when Mr. G. Astle, of 22, Park Row, Leeds, reported that the liabilities were £1,362, and the net assets £312. The debtor commenced trading in 1928 with a capital of £150, and last February was joined by Dennis, who, however, did not introduce any cash. A number of contracts had been carried out, and it was believed that losses had been sustained on some of them. A resolution was passed confirming the deed of assignment already executed to Mr. Astle, and a committee of the principal creditors also appointed.

Robert Taylor, electrician, 2a, Bo'ness Road, Grangemouth.—The creditors of the above were called together on September 26th at the offices of Messrs. McMillan & Henderson, when it was reported that the liabilities were £374, and the net assets £29. The estate showed approximately 1s. 6d. in the £. It was stated that the debtor had been trading for a number of years, having commenced with a capital advanced by his brother, who was the cash creditor shown in the statement. The drawings had been approximately £4 a week. In the absence of any offer, it was decided that the estate should be realised under a trust deed in favour of Mr. McMillan, whilst a committee was also appointed. The following are creditors:—

	£		£
Holland House Elec. Co., Ltd.	25	Walker Electrical Service	24
		Fotheringham, J. ...	27

New Catalogues and Lists.

Lisenin Wireless Co., 5, Central Buildings, High Street, Slough.—A folder illustrating radio positive grip plugs and sockets. Priced.

Erskine, Heap & Co., Ltd., Lancashire Switchgear Works, Caroline Street, Broughton, Manchester.—Pamphlets Nos. O.S. 24 and I. 23, describing, respectively, heavy duty oil circuit breakers and long-scale moving-iron instruments for a.c. and d.c. circuits.

Drake & Gorham Wholesale, Ltd., 67, Long Acre, W.C.2.—Pamphlet No. 470 of the company's electric fires, irons, kettles, &c., with illustrations and prices. The cover has a humorous picture entitled "The Traitor," showing a chimney-sweep in an armchair enjoying the comforts of an electric fire.

Mr. O. N. Beck, 11, Queen Victoria Street, E.C.4.—An illustrated leaflet drawing attention to the "Opifex" quick-closing blow-off valve.

Messrs. Joseph Kaye & Sons, Ltd., 93, High Holborn, W.C.1.—Leaflets Nos. 66 and 99, dealing, respectively, with the "K" oilcan and oil economisers.

Igranic Electric Co., Ltd., 149, Queen Victoria Street, E.C.4.—Two illustrated booklets, fully illustrated and priced, of the company's radio accessories; also a number of leaflets giving particulars of the neutrosonic short-wave receiver, the A.C. 3 receiver and radio-gramophone model; a 5-valve portable receiver, and the Super-Phonovox pick-up and tone arm.

Edison Swan Electric Co., Ltd., 123-5, Queen Victoria Street, E.C.4.—Four publications containing, with illustrations and prices, particulars of radio receivers, battery eliminators, chargers and power components, radio accessories and constructors' components, and "Mazda" radio valves.

Messrs. J. H. Tucker & Co., Ltd., Kings Road, Tyseley, Birmingham.—An illustrated price list of the company's switches and accessories.

Lighting Trades, Ltd., 30-31, Farringdon Street, E.C.4.—An electric lighting glassware catalogue containing numerous illustrations, with colour sections, of bowl, globe and shade fittings. The cover design combines simplicity with effectiveness.

Messrs. Thorpe & Bosco, Ltd., 38, Broad Street, Golden Square, W.1.—A neat booklet containing illustrations of several large electrical installations carried out by the company, and some sensible notes on electricity and electrical installations.

Midland Electric Manufacturing Co., Ltd., Birmingham.—An illustrated folder drawing attention to the new "Memrex-Senior" ironclad switch and fuse gear which the company has recently produced.

Metro-Vick Supplies, Metro-Vick House, 155, Charing Cross Road, W.C.—Brochure No. 7102/8 illustrating "Cosmos" lamps for domestic and industrial purposes. Priced.

Chloride Electrical Storage Co., Ltd., Clifton Junction, nr. Manchester.—A publication entitled "Standby Power" dealing with the various uses of storage batteries on board ship with particular reference to "Exide" storage batteries. Some illustrations of vessels in which these batteries are installed are included.

General Electric Co., Ltd., Magnet House, Kingsway, W.C.—A leaflet setting out the advantages of "Osram" pearl lamps. Priced.

Calendar-blotters for October have been received from the Jackson Electric Stove Co., Ltd., 143, Sloane Street, S.W.; Messrs. Arthur Ling & Co., Ltd., 138, Fetter Lane, E.C.4; Messrs. Mavor & Coulson, Ltd., 47, Broad Street, Mile-End, Glasgow; Enfield Cable Works, Ltd., Lincoln House, 296-302, High Holborn, W.C.1; Pope's Electric Lamp Co., Ltd., Elasta House, 5, Arthur Street, New Oxford Street, W.C.; and Warren Bros. (Middlesbrough), Ltd., Middlesbrough.

Messrs. Chas. Lather & Co., Ltd., Moat Foundry, Tipton.—An illustrated and priced list of the company's fires, irons, boiling plates, &c.

Tungsram Electric Lamp Works (Great Britain), Ltd., 72, Oxford Street, W.—A folder drawing attention to Tungsram lamps. Illustrated and priced.

Furse Wholesale, Ltd., Traffic Street, Nottingham.—A net trade buyers' list (No. 24/29) of electrical supplies, apparatus and appliances.

Pope's Electric Lamp Co., Ltd., Elasta House, 5, Arthur Street, New Oxford Street, W.C.2.—A September price list of "Elasta" lamps.

Universal Manufacturing Co., 7c, St. George's Circus, S.E.1.—A card showing the colours with which the company treats lamps, &c.

Furse Wholesale, Ltd., Traffic Street, Nottingham.—Price list No. 24/29 of electrical supplies, apparatus and appliances.

Messrs. Ross, Courtney & Co., Ltd., Ashbrook Road, N.—A leaflet advertising the "Little Jackie" hydraulic jacks.

Messrs. C. H. Parsons, Ltd., Britannia Works, Wharfdale Road, Tyseley, Birmingham.—A comprehensive catalogue of "Britmac" switches and lampholders. Illustrated and priced.

Messrs. Galliers, 32, St. James' Street, Brighton.—The October number of this company's Electrical Bulletin deals with its exhibits at the Brighton electrical exhibition, now being held, and includes a list of broadcast items to be given during the current month.

Electric Incubator Heaters, Curfew Poultry Farm, Gogmore Lane, Chertsey.—A booklet giving details of the "Curfew" electric incubator heater. Illustrated and priced.

For Sale.

Tenders are invited for the purchase of generating plant at the Royal Air Force Station, Sealand, near Chester. East Retford Borough Council has for disposal Belliss & Morcom steam generating plant. (See our advertisement pages to-day.)

Electrical Exhibition at Kingston-on-Thames.

An electrical exhibition organised by the Kingston-on-Thames Corporation Electricity and Lighting Committee is to be formally inaugurated by the Mayor at Baths Hall, Wood Street, on October 14th.

The South American Mission.

Members of the Economic Mission to South America were expected to arrive at Southampton yesterday (Thursday) by the s.s. *Asturias*, after an absence of about two months. In addition to concluding a satisfactory trade agreement with Argentina, the Mission collected a great deal of useful trade information relating to Argentina, Brazil and Uruguay.

Prices of Materials.

Messrs. F. Smith & Co. and Messrs. James & Shakespeare report, October 8th: No change in copper prices.

Messrs. James & Shakespeare report, October 8th: English pig lead, £24 15s., 5s. dec.

Messrs. Edward Till & Co. report, October 8th: India-rubber, Para fine, 10½d., ½d. dec.

Messrs. James Forster & Co., reporting on October 5th, stated that owing to the lack of demand from consumers, the lead market last week sagged daily and prices closed at the lowest. The Producers' Association has been offering, but generally speaking, its price rules above the market level. It is expected that arrivals this month will be rather short, in fact warehouse lead has already been declared to meet consumers' requirements. However, the Australian shipments during September are reported to be 17,367 tons against 8,163 tons in August, so that any shortage of arrivals is likely to be only temporary. The position is sound enough and probably justifies the present level of prices.

Lighting and Power Notes.

Barking.—Loans.—The Urban District Council Electricity Committee is to apply for sanction to a loan for the wiring of houses on the Eastbury estate. Allowing for nine points per house, a loan of £2,682 will be required. The Committee has also obtained sanction to a loan of £3,000 for mains extensions.

New Cables.—The Urban District Council is to lay additional cables in the Hertfo d Road district, at a cost of £3,000.

Barnstaple.—Special Order.—The Rural District Council has given its consent to an application by the Ilfracombe Electric Light & Power Co., Ltd., for a Special Order to supply electricity to Morte-Hoe, Berrynarbor, Georgeham, Westdown, and Bittadon. The supply will be by means of overhead lines.

Birkenhead.—Loans.—The Corporation Electricity Committee has applied for sanction to loans of £2,500 for overhead distributing lines, £4,000 for feeders, £2,000 for sub-station equipment, and £1,500 for small static sub-stations and kiosks.

Blackpool.—Loan.—The Corporation has applied for sanction to a loan of £6,200 for feeder extensions.

Boston.—Supply Inauguration.—During the last few weeks a public electricity supply has been inaugurated in the towns of Long Sutton and Sutton Bridge, and the parishes of Fleet and Little Sutton. These districts are supplied from the Mount Bridge power station of the Boston and District Electric Supply Co., Ltd., by means of 11,000-V, 3-phase overhead lines, these lines being extensions from the Boston-Holbeach transmission line. The company is carrying out the street-lighting scheme at Long Sutton, the majority of the lamps being switched on on September 14th last. The whole of the public lighting at Holbeach has also been converted to electricity. The charges in the area are 8d. per kWh for lighting, 2½d. per kWh for small motive power, 2d. per kWh for heating and cooking, and 1½d. per kWh, plus a fixed quarterly charge under an "all-in" tariff.

Buckie.—Street Lighting.—The Town Council has approved a scheme for lighting the town by electricity at an estimated cost of £14,325. The scheme provides for buildings, plant, cables, the lighting of the streets and the harbour, and also the cost of the Order. The charges suggested at the outset are 8d. per kWh for lighting and 4d. for power and heating purposes.

Chapel-en-le-Frith.—Inauguration of Supply.—The ceremony of switching on the supply of electricity for Chapel-en-le-Frith, Whaley Bridge, Chinley and Disley was performed on October 3rd by Mr. W. H. Flanagan, ex-M.P. for the Clayton Division of Manchester. The scheme has been carried out by the Trent Valley and High Peak Electricity Co., Ltd., and is stated to have cost the company £40,000.

Chesterfield.—Price Reduction.—The charge for electricity for lighting has been reduced from 4d. to 3½d. per kWh.

Chichester.—Loan.—The Town Council is to apply for sanction to a loan of £10,000 for mains extensions.

Continental.—France.—The Société d'Electricité de Paris lately placed a contract with the Oerlikon Co. for a 75,000-h.p. steam turbine which is to be directly-coupled to a Jeumont alternator. The latter is to run at 3,000 r.p.m. and is to have a continuous capacity of 50,000 kW, generating at 10,500 V at a power factor of 70. The new plant is to be installed in the power station at Saint Denis, Paris. Steam at a pressure of 782 lb. per sq. in. superheated to a temperature of 842 deg. F. is to be used in three stages, that is, in one high-pressure, one medium pressure, and two low-pressure sections, all mounted on the same shaft and designed to run at 3,000 r.p.m. The turbine is being built with the stipulation that it must be capable of running continuously with steam at pressures between 710 and 850 lb. per sq. in. and occasionally at 995 lb. The set, including the exciter, will be not less than 98½ ft. in length and will weigh about 332 tons. The exhaust steam from the turbines will be condensed in four Delas-type surface condensers about 21 ft. in length and 6½ ft. in diameter.

Greece.—The Greek Ministry of Communications is inviting offers for the concession for the utilisation of the water-power resources of Macedonia for electricity generation purposes, and in particular the power of the Verria, Vodena, and Veldovo falls and the rivers Achelco and Aliakmon.

Doncaster.—Loan.—The Town Council is to apply for sanction to a loan of £10,750 for electrical equipment for the new Bemberg artificial silk works.

Eastbourne.—New Plant.—The Corporation Electricity Committee is applying for sanction to the borrowing of £16,000 for the provision of a 2,500-kW turbo-alternator, £16,000 for a new boiler, and £6,000 for the provision of a switchhouse.

Glasgow.—Housing Scheme Supply.—In connection with the supply of electricity to the Corporation's housing schemes, it has been decided to give notice to the Clyde Valley Electrical Power Co., that it is the intention of the Corporation to take over the distribution of the supply to the Shettleston and Tollcross areas at the end of the current year. Under the

Order granted to the Clyde Valley Electrical Power Co., it had the right to supply these areas, but this Order was granted while they were under the Lanarkshire County Council. When the areas came within the boundary of Glasgow, the Corporation took over the agreement and is entitled on January 1st next to take over the distribution of the electricity supply. The Corporation must, however, continue to take the supply in bulk from the Clyde Valley Co.

Halifax.—New Cables.—The Corporation Electricity Committee has applied to the Unemployment Grants Committee for a grant towards the laying of new cables on the Hebden Bridge service, at an estimated cost of £7,961.

Hungerford.—Bulk Supply.—The power station has been closed down, and a bulk supply was recently formally inaugurated. The supply is provided by the Wessex Electricity Supply Co., Ltd., which arranged an electrical exhibition to demonstrate the uses of electricity in the home. The charge for lighting has been reduced from 1s. to 10d. per kWh.

Irish Free State.—Enniskillen (Co. Fermanagh).—The town was lighted by electricity for the first time when the electricity supply was switched on by Mr. Robert Proctor, the chairman of the Lighting Committee of the Urban District Council at the inauguration ceremony held recently at the power house.

The Shannon Scheme.—The Dublin correspondent of *The Times* reports that on October 5th, for the first time, electricity from the Shannon was used to light the centres of population comprised in the Leinster loop. The area embraces all Leinster towns from Waterford to the municipal boundaries of Dublin. A double transmission line connects Ardnacrusha with Dublin, and all power for Leinster will be distributed from the Dublin transmission station. The Leinster circuit is being tested at present, and afterwards power will be supplied to transmission lines in Munster and Connaught. It is hoped that the power station at Ardnacrusha will be put into commercial use before the end of the present month.

Lancaster.—Electricity Extensions Scheme.—The Corporation Electricity Committee has submitted to the Unemployment Grants Committee a scheme of cable and service extensions in the town estimated to cost £20,000, of which the Corporation would have to provide £12,500.

Leeds.—Loans.—The Corporation Electricity Committee has recommended application for sanction to loans of £175,000 for services and £50,000 for assisted wiring.

London.—Bermondsey.—The Borough Council Electricity Committee has decided that the official opening of the new sub-station shall take place on Saturday, October 26th, the ceremony to be performed by the Mayor.

St. Marylebone.—The Borough Council Electric Supply Committee is applying for sanction to a loan of £50,000 for mains and services and transformer stations on consumers' premises during the following two years.

With reference to its appointment of experts to report upon the precautions to be taken in connection with the operation of the generating station, the Electric Supply Committee has reported that it has interviewed the experts, informed them of the reasons which induced the Council to appoint them and outlined the Council's wish in the matter. It was agreed that the total fee payable to the four experts engaged should not exceed £1,600 for individual reports or a concerted report by the experts, and it is anticipated that such report or reports will be in the town clerk's hands not later than the end of the current month.

The Committee has also reported the receipt of a letter from the Electricity Commissioners stating that they have been in consultation with the Central Electricity Board and are given to understand that a bulk supply of electricity is not at present available for the Council's growing requirements, and that it would be advisable to proceed at once with the installation of a 25,000-kW turbo-alternator set, &c. The Board has intimated that it is prepared, subject to the approval of the Commissioners, to give its sanction to the proposed extensions.

Hackney.—The Borough Finance Committee has recommended that application shall be made for a loan of £9,823 for extensions to sub-stations and plant.

The Electricity Committee has recommended the laying of l.p. feeders at a cost of £8,205.

Maidstone.—Year's Working.—The accounts of the Corporation Electricity Department (engineer and manager: Mr. E. E. Hoadley) for the year ended March 31st last show a total revenue of £99,650, as compared with £94,367 in the preceding year, and a working expenditure of £52,741, as against £61,147, leaving a gross profit of £46,909 (£33,220). To the gross profit was added income from other sources, making a total of £47,830 available, and, after providing for capital and other charges, there was a net surplus of £13,719, as compared with £6,228 in 1927-28. The capital expenditure during the year amounted to £39,857, and included £18,036 for machinery and £11,654 for mains. The total now spent on the undertaking stands at £501,307. The sales of electricity increased from 17,573,183 to 21,086,246 kWh, and the maximum supply demanded from 7,235 to 7,710 kW.

Malaya.—Malacca.—Following the refusal of the Malacca Electric Lighting Co. to reduce the maximum charge for electricity to 30 cents per kWh, an attempt has been made to establish a rival electricity company. Sanction has, however, been refused by the Federal Commissioners, and the Chinese Chamber of Commerce is now organising a public petition to the Governor.

Oswestry.—Purchase of Undertaking.—At a special meeting of the Town Council, held recently, the Corporation decided to take over the undertaking of the Oswestry Electric Lighting and Power Co., Ltd., as from October 1st. The price of the undertaking is not yet fixed, but it was agreed that the staff of the company should be employed by the Corporation. It was also decided that the North Wales Power Co., Ltd., should be approached with regard to effecting a fresh agreement for a bulk supply.

Special Orders.—Application is being made to the Electricity Commissioners by Wigan Corporation for a Special Order authorising it to supply electricity in the urban districts of Standish with Langtree and Upholland, and part of the rural district of Wigan.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising East Grinstead Urban District Council to supply electricity in part of the rural district of Godstone.

Stalybridge.—Loans.—The Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board is to apply for sanction to loans of £2,673 for excess expenditure on plant and plant foundations, £25,000 for mains, and £10,000 for transformers and switchgear on consumers' premises.

Stockport.—Inauguration of Bulk Supply.—The ceremony of switching on the bulk supply of electricity to an area including Macclesfield, Buxton, Poynton, New Mills, Chapel-en-le-Frith, and Marple was performed on September 30th by the chairman of the Corporation Electricity Committee. This is the first section of the Central Electricity Board's North-Western scheme to be completed.

Stranraer.—Street Lighting.—The Town Council has decided to grant the Holderness Trust, London, permission to apply for a Special Order to light the streets of the town at 2½d. per kWh.

Stretford.—Year's Working.—We have received from Mr. T. A. Kerr, engineer of the Urban District Council's Electricity Department, the accounts of the undertaking for the year ended March 31st last. The total revenue amounted to £201,271, as compared with £213,568 in the preceding year, and the working expenditure was £128,797, as against £135,580, leaving a gross profit of £72,474 (£77,988). To the gross profit was added income from other sources, making a total of £72,729 available, and, after payment of loan and other charges, there was a net surplus of £9,660, as compared with £24,082 in 1927-28. The capital expenditure during the year amounted to £28,054, the chief item being £21,557 for mains and services. The consumption of electricity for private power purposes increased from 49,322,389 to 51,526,154 kWh, and the total sales from 54,341,792 to 57,146,921 kWh. The maximum supply demanded rose from 18,040 to 19,244 kW.

Swinton.—Street Lighting.—The Urban District Council has decided to use electricity entirely for street lighting purposes, the installation to be made by the Rotherham Corporation. The Council is a partner with the Mexborough Urban District Council in a municipal gas undertaking.

United States.—Hydro-Electric Developments.—According to *Power* a permit granting water rights on the North River for the proposed $2,250,000 hydro-electric power project in Grays Harbour County, Washington, has been granted to the Western Washington Electric Light & Power Co., of Aberdeen, Washington. The undertaking, which will produce 54,545 theoretical h.p. and 25,000 installed electrical h.p., will require an appropriation of 5,000 sec. ft. of water from the flow of the North River, a tributary of Willapa Harbour. Rights were issued by the state hydraulics supervisor for the impounding of a total of 272,000 acre-ft. of water in a reservoir which will result from the construction of a concrete arch-type dam 153 ft. high, 400 ft. wide at the crest, and 180 ft. wide at the base. The development, to be completed on or before June 1st, 1932, will have its power plant situated at a stream point about ten miles south of the south shore of Grays Harbour, according to the plans. An application by the North-West Power Co., a subsidiary of the Portland Electric Power Co., Portland, Oregon, for rights along the river and Marion Lake is now pending. A joint hearing was held on September 24th before the State Reclamation Commission and the Federal Power Commission. The proposed development contemplates a storage project on Marion Lake, construction of a dam which will raise the waters of the lake nearly 70 ft., and a power plant on the North Santiam River, near Detroit, Oregon. It is proposed to develop 32,000 h.p. In the East tentative approval has been granted by the Federal Power Commission for the construction of a $10,000,000 hydro-electric and flood-control project on the Chattahoochee River, near West Point, Ga. When completed and tied into the existing power facilities of the West Point Manufacturing Co., about 100,000 h.p. will be available, it is estimated.

Weymouth.—New Electricity Charges.—The Town Council has adopted the following revised scale of charges within the borough:—Lighting, 6d. per kWh, with discount; heating,

1½d. per kWh; power, 1½d. per kWh; water heating, ¾d. per kWh; cooking, ¾d. per kWh; domestic contract, ¾d. per kWh; business contract, 1½d. per kWh. An additional charge is made for electricity outside the borough.

Winchester.—Year's Working.—The report of the city electrical engineer (Mr. R. Ayton) on the working of the electricity undertaking for the year ended March 31st last records a total income of £38,191, as compared with £40,450, and working expenses of £19,831, as against £25,270, leaving a gross profit of £18,360 (£15,180). To the gross profit was added revenue from other sources, making a total of £19,038, and after deducting capital charges (£11,378), capital expenditure charged to revenue (£1,694), and £398 written off for depreciation, there was a net surplus of £5,568, as compared with £3,000 in 1927-28. The sales of electrical energy increased from 2,411,994 to 2,754,778 kWh, and the maximum supply demanded from 1,372 to 1,459 kW.

Tramway and Railway Notes.

Blackpool.—Tramway Employes' Wages.—The Transport Committee has instructed the Transport Officer to bring before the Municipal Tramways Association an application by the Transport Workers' Union for increased pay for employés engaged on one-man operated vehicles.

Bradford.—Year's Working.—We have received from Mr. R. H. Wilkinson, the general manager of the Corporation tramway undertaking, a copy of his report together with the statement of accounts for the year ended March 31st last. The total revenue amounted to £568,052, as compared with £597,281 in 1927-28, and working expenses were £458,412, as against £470,849, leaving a gross profit of £109,640 (£126,433). The railless-car system showed a total income of £54,299, and working expenses of £51,551, leaving a gross profit of £2,748. The figures for the preceding year were: Income, £45,372; working expenses, £44,523; gross profit, £849. The motor-omnibus system and the Parcels Department recorded gross profits of £13,870 and £1,157 respectively, and these, with the gross profits from the tramway and railless-cars, and revenue from other sources, were carried to net revenue account, making a total of £147,000 available. Capital and other charges absorbed £137,360, and there was a net surplus of £9,640, as compared with £34,288 in the previous year. The capital expenditure during the year amounted to £102,612, the chief items being £32,189 for permanent way, £11,580 for railless-cars, and £52,963 for 'buses. The number of passengers carried increased from 112,367,506 (tramways 96,860,739, railless-cars 7,029,025) to 116,435,647 (tramways 93,589,130, railless-cars 8,532,938), and the car-mileage from 9,411,147 (tramways 7,356,775, railless-cars 905,069) to 10,376,868 (tramway 7,313,725, railless-cars 1,081,848). The total revenue per car-mile fell from 18.246d. to 17.138d.

Burnley.—Superannuation Scheme.—An application was made recently by the tramway manager, on behalf of members of his staff, taken over by the Corporation when the undertaking was purchased from the Tramway Company in 1901, that they should be included in the new scheme of superannuation. Application was also made for an increase in superannuation allowance payable for non-contributory service, or, alternatively, an extension of the period of service. The Corporation has refused both these requests.

Chatham.—Tramway Abandonment.—It was reported at a recent meeting of the Rochester Town Council that negotiations had been concluded and terms arranged with the Chatham and District Light Railways Co. for the removal of the tramway system. It was also stated that the Ministry of Transport had intimated that it was prepared to make an Order authorising the abandonment of the tramways, and the substitution of 'buses. The company has suggested September 30th, 1930, as the date for the abandonment of the trams.

Continental.—Lithuania.—The question of the construction of an electric tramway at Kaunas has been considered by a committee of engineers and the Lithuanian Home Office. The latter has decided that the proposal made some time ago by a German firm, to build the tramway at once, with lines throughout the city, is unacceptable, and approves a plan whereby the City Board itself will build the tramway gradually. In the first place, it is proposed to run the line from the railway station to Panemuné, where it will be possible to utilise the rails of the present light railway.—*Reuter's Trade Service.*

Switzerland.—The budget of the Swiss Federal Railways for 1930 includes provision for 75 new electric locomotives and motor-equipped carriages.

Glasgow.—Doubling of Track.—The Corporation Tramways Committee has recommended that application be made for sanction to double the tramway track in High Street, Renfrew.

Passenger Traffic Monopoly.—The Corporation is to make application in December next for a monopoly of the road passenger traffic within the city and on tramway routes outside the city.

Ilford.—Year's Working.—The report of Mr. L. E. Harvey, engineer and manager of the Borough Tramways Department, on the working of the undertaking for the year ended March 31st last records a total revenue of £77,456, as compared with £77,595 in the preceding year. Working expenses amounted to £58,994, as against £57,880, leaving a gross profit of £18,462 (£19,715), to which was added income from other sources, making a total of £21,574 available. After deducting capital and other charges, there was a net surplus of £7,725, as compared with £8,674 in 1927-28. The number of passengers carried increased from 15,829,480 to 15,880,953, and the car-miles run from 1,076,378 to 1,111,686. The average total revenue per car-mile fell from 17.301d. to 16.722d.

Leeds.—Tramway Construction.—The Corporation Tramways Committee has referred to the Parliamentary Committee the question of including in the next Bill to be promoted by the Corporation in Parliament provisions for the purpose of (*a*) extending the time allowed for the construction of the section of the tramway from Selby Road, and (*b*) authorising the construction of tramways from Roundhay Road to Hollin Park, *via* Easterly Road, West Street, to Wellington Street, *via* St. Phillip's Street, and Kirkgate to New York Street, *via* Harper Street.

Tramcar Construction Scheme.—The Corporation Tramways Committee has referred the scheme for the construction of 150 tramcars for replacements to the Industrial Conditions Committee, as suitable to be carried out for the relief of unemployment with the assistance of grants from the Government.

London.—Piccadilly Circus Station.—Large electric light standards are now replacing the smaller type of standard at Piccadilly Circus Station. Each standard gives a total of 500 candle-power, as against 200 in the older type. They will be installed upon all the sites now occupied by the smaller standards on the lower landings. The new form of lighting fitting consists of a bronze column which broadens into a basin at the top, like a fountain, and is surmounted by a large reflector.

The Underground's Winter Programme.—On Monday last, October 7th, the Underground Companies introduced their winter programme of improved train services. Compared with last winter, there are 112 more cars running. The speed of trains on all lines has been increased, and closer interval services provided. The improved running times have been made possible by the trains being fitted with new and more powerful motor equipment. Improvements in the signalling installations have made shorter headways possible.

Lytham-St. Anne's.—Inquiry into Administration.—At a meeting of the Town Council, held recently, the Mayor referred to the decision of the Tramways Sub-Committee recommending the re-appointment of a special committee to inquire into the affairs of the department, and said this move was taken because they were not satisfied with the tramways. The committee would look into matters to see if an improvement could be introduced. During the year the Tramways Department had lost several thousands of pounds, and the general impression was the position should be investigated.

Manchester.—Tramway Extensions.—The Corporation Tramways Committee has given instructions for the work of constructing the tramway along Aytoun Street to be proceeded with.

Portsmouth.—Traffic Noises.—A special committee has been appointed to inquire into the question of noise and vibration caused by trams and other vehicles in certain streets in the city.

York.—The Future of the Tramways.—In a report prepared with regard to future transport within the city, the tramway manager advises that in order to reduce the capital debt the tramway service should be maintained for a further ten years. He suggests that, if a route becomes worn out it should be abandoned and a railless-car service substituted. In presenting the report the Tramways and Motors Committee states that it is not prepared to make any recommendation as to what system should be adopted when the trams are discontinued. It recommends, however, that the Committee should be authorised to sell its Piccadilly car depôt, to obtain tenders for a new garage at Fulford, and to discontinue the present railless-car services at the end of the current year and replace them by motor-omnibuses.

Electricity in Swedish Horticulture.

According to the British United Press, electricity is extensively used in Sweden for horticulture, for heating the earth, and as a substitute for sunlight.

In the experimental garden at Hemlingby, on the north-east coast of Sweden, 10,000 tulips, 1,500 lilies of the valley, and 1,500 hyacinths were grown with the aid of electricity last January, and the cost of the current used was found to be about 1 per cent. of the value of the plants.

As a substitute for sunshine the use of electricity is still in the experimental stage, and is a more difficult problem, owing to the varying sensibility of plants to different kinds of light, but important and encouraging results have been achieved. It is hoped that natural climatic conditions can thus be overcome.

Telegraph and Telephone Notes.

China.—Automattic Telephony.—One of the oldest cities in the world, Canton, has recently put into service the most modern type of automatic telephones. The China Electric Company, a subsidiary of the International Telegraph and Telephone Corporation of New York, installed the system for 4,000 lines.

International Telephony.—The Riviera.—Communication between the littoral beyond Marseilles and the rest of France has not hitherto been all that it should be. Owing to the increasing importance of the Riviera towns, which are now as full in summer as in winter, it was decided to lay an underground telephone cable to link Marseilles with Cannes, Nice, Monaco, and Mentone, and connect with the new underground cable from Paris to Marseilles. The new Riviera circuits will be completed a year from now, when it should be possible to ring up London from Cannes or Nice without difficulty. Meanwhile the authorities are effecting immediate improvements in the service; seven lines will link Paris with Nice during the coming winter, instead of four, and two lines will connect the capital with Cannes.—*Reuter's* (Paris).

South America. — Ericsson Telephones. — The L.M. Ericsson Telephone Co. has made rapid progress in Latin-America, according to a statement by the director of the company, Mr. K. F. Wincrantz, who, on his return from a long journey abroad to Stockholm, said that the company's concession in the Argentine had been considerably extended. In the north-western part of that country a new automatic telephone system would be built. In Mexico the number of subscribers on the company's automatic telephone network was growing, and by the end of this year would have reached 40,000. The company had recently acquired a large new telephone system in the northern and western parts of Mexico. Important negotiations for new concessions in other Latin-American countries were at present being carried on.

The Telephone Service.—Police Call Boxes.—Progress is being made with the scheme to provide a network of police telephone boxes throughout the 700 square miles of the metropolitan police area; between 800 and 1,000 boxes are to be installed.

Twenty-one boxes have been erected in the Richmond (Surrey) district, and it is hoped that they will be in use before Christmas. Twenty boxes are also being set up in the Wood Green, N., area. The majority will be in the outer areas of London, but there will be a number at important strategic points in the inner areas. Similar boxes have proved of considerable value in provincial towns, while there has been great saving in the closing down of sub-stations. They are intended to serve as sub-headquarters for policemen on their beats. In case of emergency, the central station will be able to get into touch immediately with the men by switching on lamps which can be seen through the glass panels of the boxes.

Cheaper Trunk Calls.—Substantial reductions in the rates for all trunk telephone calls over distances exceeding 200 miles between places in Great Britain, Northern Ireland, and the Isle of Man became effective on October 1st. Some adjustments will be also made to charges for calls in the afternoon period, over distances of from 100 to 200 miles.

The "personal call" system, which was introduced in the trunk and toll services in this country on August 1st last, has been extended to all the Anglo-Continental telephone services, except that with Switzerland.

Radio Notes.

Regional Stations.—South-Eastern Area.—It is expected that the Brookman's Park station will radiate the whole of the London programme (2LO), 842 kc., 356.3 metres, by the end of this month, when the London Oxford Street transmitter will be shut down. When the alternative transmitter will be ready to operate at 1,148 kc. (261.3 metres) has not yet been settled.

Northern Area.—The site of the north regional transmitter has been chosen at Moorside Edge, near Huddersfield; building operations are to commence at once, and the station will contain two transmitters of similar design to those at Brookman's Park. It is expected that its two frequencies will be 626 kc. (479.2 metres) and 995 kc. (301.5 metres), the separation, therefore, being 369 kc. The frequency of 626 kc. 479.2 metres) is being allotted to Manchester as it is the lowest of the Corporation's exclusive frequencies (with the exception of that of Daventry, 5XX), and, therefore, particularly suitable for service in the hilly and exceptionally populous country within 100 miles radius of Huddersfield. It is not expected that the Manchester station will be completed and working on a service basis until the end of 1930. *World-Radio* recalls the fact that in June last the Newcastle station was moved up temporarily from 1.230 kc. (243.9 metres) to 1,148 kc. (261 metres), and points out that it would be impossible to reserve an exclusive frequency for Newcastle for the whole of the time during which the regional scheme is being introduced. Thus, it becomes necessary temporarily to add Newcastle to those stations already working on the national common frequency 1,040 kc. (288.5 metres), which change will take effect on October 31st. During the period between October 31st and the opening of the plant at Moorside Edge, no programme can originate at Newcastle through its own transmitter only, due to the synchronisation of its wavelength with those of other stations in the North. It is intended, however, to include distinctive local features for radiation by all stations of the northern group working on the frequency of 1,040 kc. As soon as the new twin-wave transmitter at Moorside Edge takes over for the North of England, a frequency will be made available for Newcastle which will allow the transmission of programmes locally.

Scottish Area.—Various sites for the Scottish regional transmitter are being investigated. It is probable that building operations will begin for the Scottish station before the Manchester regional station is completed. Similarly, it is hoped to start work on the West regional station before the Scottish station is completed. The order in which the stations are being built has been decided in accordance with the density of the population falling within their respective service areas, and also upon the service already provided in the various districts by the old system of distribution.

Midland Area.—The Corporation has received some inquiries concerning the future of Daventry (5GB). The intention is to maintain it, based on Birmingham, as the transmitter for the Midlands. There is, of course, no intention of closing down Daventry, 5XX.

Television.—B.B.C. Transmission.—The first public test of the Baird system of television was made on September 30th, when a programme was broadcast from 2LO between 11 and 11.30 a.m. Sound and sight were broadcast alternately, as only one wave-length was available. Listeners using ordinary receiving sets heard the announcements accompanying the tests, but there was only a deep drone while the face of the speaker was being transmitted by land line from Mr. Baird's offices in Long Acre, to the B.B.C. control room, and from there to its Oxford Street transmitter. The tests will continue from 11 to 11.30 a.m. daily, except on Saturdays and Sundays.

Wave-lengths.—International Classification.—The International Consultative Committee for the Technique of Radio-Electric Communication has classified wireless wave-lengths as follows:—

	Metres.
Long	3,000 and upwards
Medium	200 to 3,000
Intermediate	50 to 200
Short	10 to 50
Ultra-short	Beelow 10

The committee recommends that, to prevent interference, the regulations drawn up at the Washington Conference last year for limiting the power of transmitters in North America should be generally applied.

The Royal Commission on Transport.

According to *The Times*, the Royal Commission on Transport met in public on October 4th and heard evidence given on behalf of the London County Council. Sir Arthur Griffith-Boscawen presided. Mr. C. W. Matthews, chairman of the Highways Committee of the London County Council, said that the Council was convinced of the vital part which tramways necessarily played in the provision of adequate means of transport for Greater London. While the Council's tramways carried an average of some 2,000,000 passengers a day, no fewer than 800,000 had to be carried within about four hours of the day. Large crowds were more easily transported by the tramways than by railway or omnibus, and at a cheaper rate per head. Referring to risks to passengers, the witness said that in Glasgow and Edinburgh there were by-laws making it an offence for vehicles to pass a tramcar on the near side when it is picking up and setting down passengers. There was no power to make by-laws of that kind in England and Wales. The number of accidents of this kind in London had grown between 1919-20 and 1928-29 from 8 fatal and 137 non-fatal to 13 fatal and 818 non-fatal cases. The Council considered that the existing measures for safeguarding passengers were inadequate. The relief from omnibus competition had been disappointing. A reduction in the number of omnibuses on routes served by the Council's tramways had taken place only on the Clapham route, where ten omnibuses had been eliminated. There was no restriction on Sundays. On the other hand, the capacity of omnibuses had increased and the Council thought that the Minister of Transport should exercise with greater energy the power conferred on him by the London Traffic Act of 1924 to reduce omnibus competition. For the financial year 1929-30, it was estimated that there would be a net surplus of £40,899 on the operation of the tramways. The next public sitting of the Royal Commission will be on October 29th.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Argentina.—BUENOS AIRES.—November 4th. Argentine State Railways. Turbo-generator sets and headlights for locomotives. (B.X. 5657.)*

Australia. — MELBOURNE. — State Electricity Commission. December 16th. Oscillograph equipment. (B.X. 5692.)*
Posts and Telegraphs Department. November 12th. Telephone receivers and parts. (B.X. 5656.)* Transmitters and parts. (B.X. 5653.)*
November 19th. Telephone generators and motor-generators. (B.X. 5662.)*
November 19th. Motor-generators. (B.X. 5694.)*
November 26th. Vitreous resistances. (B.X. 5696.)*
November 27th. City Council. 6,600-V, 3-phase switchgear. (B.X. 5708.)*
SYDNEY.—October 29th. New South Wales Government Railways. Railway traction motor-testing equipment. (B.X. 5693.)*

Belfast.—October 21st. Electricity Department. Supply and delivery of circulating water pipes. October 4th.

Cardiff.—October 21st. Electricity Department. Supply and erection of a water-tube boiler, mechanical stokers, and fuel economiser. (October 4th.)

Edinburgh.—October 14th. Parish Council. Electric light and power installations at Crayleith Hospital. Forms of tender from Mr. J. M. Johnston, 47, Charlotte Street, Leith.

Egypt.—CAIRO.—November 19th. Ministry of the Interior. One Diesel-electric generating set for the Manfalout power station. (B.X. 5720.)*
November 5th. Department of Public Health. Electric refrigerators for 12 months.

Hastings.—October 23rd. Electricity Department. 22,000-V, 3-phase overhead lines and underground cables, Crowhurst Section, No. 6 (approximately 7,000 yards). 400-V, 3-phase, 4-wire overhead lines and underground cable, Crowhurst Section No. 7 (approximately 4,200 yards). 400-V, 3-phase, 4-wire, overhead lines and underground cable, Whatlington Road, Section No. 8 (approximately 1,000 yards). (October 4th.)

India.—DELHI.—December 3rd. India Stores Department. Ceiling and table fans. (B.X. 5672.)*

London.—SOUTHWARK.—October 22nd. Borough Council. Electric cable for 12 months. (September 13th.)
CENTRAL ELECTRICITY BOARD.—November 9th. Supply, delivery, and erection of 33,000-V overhead transmission lines in South Lincolnshire. (September 27th.)
H.M. COMMISSIONERS OF WORKS.—October 22nd. Supply of steel conduits and fittings for electric wiring, and cable and wire. (See this issue.)

Manchester.—October 15th. Board of Guardians. Electric lamps. Tender forms from Mr. F. W. Greenhalgh, Clerk to the Guardians, Union Offices, All Saints', Manchester.
October 23rd. Electricity Committee. Supply, delivery and erection of four 33,000-V, 500,000-kVA rupturing capacity switch units, and two 10,000-kVA, 33,000/6,600-V indoor-type transformers. (October 4th.)

New Zealand.—WELLINGTON.—Post and Telegraph Department. November 12th. Four-conductor operator cords. (B.X. 5685.)*
November 18th. Resistance spools. (B.X. 5716.)*
November 19th. Telephone transformers. (B.X. 5718.)*
Automatic wall and table telephones. (B.X. 5717.)*
October 21st. Switchboard cords. (B.X. 5715.)*
Public Works Department. November 12th. 15-kW oil-engine-driven generating set for installation on the "Main Pomare." (B.X. 5683)*
AUCKLAND.—Auckland Electric Power Board. November 4th. Distribution pillar shells and link units and cable sealing ends. (B.X. 5682.)*

Sheffield.—October 14th. Health Committee. Maintenance of private telephone and bell installations at Lodge Moor, Winter Street, Crimicar Lane, and Commonside Hospitals. Form of tender from Steward, Lodge Moor Hospital.

South Africa.—JOHANNESBURG.—October 26th. City Council. Time switches. (B.X. 5709.)* Three-phase, 6,600-V truck-type switchboard panels. (B.X. 5710.)*
October 31st. Three-phase and single-phase outdoor transformers. (B.X. 5736.)*

Staffordshire.—October 31st. Education Committee. Installation of electric light in two new elementary schools in course of erection at Brierley Hill. (September 27th.)

Wakefield.—October 15th. West Riding Education Committee. Installation of electric light at Thurlstone new schools. Particulars from the Education Officer, County Hall, Wakefield.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Birkenhead.—Electricity Committee. Accepted:—
6,500 yd. l.p. cable (£889).—W. T. Glover & Co., Ltd.
1,000 yd. l.p. cable (£349).—Hackbridge Cable Co., Ltd.
1 mile v.i.r. cable (£141).—Liverpool Electric Cable Co., Ltd.

Colchester.—Tramways Committee. Recommended:—
Electrically-driven oil filter.—Davey, Paxman & Co., Ltd.

Devizes.—Rural Council. Accepted:—
Installing electric light in 36 houses (£189).—A. R. Fox (Chippenham).

Dewsbury.—Borough Education Committee. Accepted:—
Installing electric lighting at the Walker infants' school.—F. Hirst.

Glasgow.—Tramways Committee. Accepted:—
Copper bonds.—T. Bolton & Sons, Ltd.

Halifax.—Tramways Committee.
Three complete tramcars, with air-brake equipment (£6,609); four separate equipments (controllers, motors and magnetic brakes) (£2,316); four M. and T. air-brake equipments (£722).—English Electric Co., Ltd.

Irish Free State.—DUBLIN.—Local Government and Public Health Department:—
Electric lamps.—Siemens Electric Lamps & Supplies, Ltd.; and Sphinx Electric Supplies (Ireland), Ltd.

Leeds.—Electricity Committee. Accepted:—
Galvanised steel tanks (£423).—Cochrane & Co.; (£690), J. R. Marsden & Co.
Cast-iron and galvanised-iron pipework (£2,235).—J. R. Marsden & Co.
Cables.—W. T. Henley's Telegraph Works Co., Ltd. (£2,015); Enfield Cable Works, Ltd. (£2,718); Macintosh Cable Co., Ltd. (£3,090); and Hackbridge Cable Co., Ltd. (£687).

London.—ST. MARYLEBONE.—Electric Supply Committee. Annual contracts:—
Transformers.—Metropolitan-Vickers Electrical Co., Ltd.; British Electric Transformer Co., Ltd.
Switchgear.—Ferguson, Pailin, Ltd.; A. Reyrolle & Co., Ltd.
Meters.—Chamberlain & Hookham, Ltd.; Ferranti, Ltd.
EDMONTON UNION.
Electric lamps.—Edison Swan Electric Co., Ltd.
WAR OFFICE.—
Vacuum and gasfilled lamps.—Edison Swan Electric Co., Ltd.

Manchester.—Electricity Committee. Accepted:—
Steam-heating pipework at Dickinson Street station.—Stewarts & Lloyds, Ltd.
Pulverised-fuel boosting plant for Stuart Street station.—Alfred Herbert, Ltd.
Maintenance of 33-kV feeder cables.—Callender's Cable and Construction Co., Ltd.
Supervisory control gear and one 5-kW motor-generator, with control gear.—Metropolitan-Vickers Electrical Co., Ltd.
Tramways Committee. Accepted:—
Thermit welding of tram rail joints.—Murex, Ltd.
Internal rail bonds.—T. Bolton & Sons, Ltd. (per Collier Bros.).
Round flexible face rail bonds.—British Insulated Cables, Ltd.
Steel tramway poles.—British Mannesmann Tube Co., Ltd.

Education Committee. Accepted :—
Electric cooker for Soss Moss special school.—Jackson Electric Stove Co., Ltd.
Electrical installation at Cooke Street domestic centre.—John Adams, Ltd.
Motor-generator set for Central High School for Boys.—Mather & Platt, Ltd.
Electric lighting installation.—A. Loudon.

Reigate.—Town Council. Accepted :—
H.p. feeder cable from the electricity works at Redhill (£1,574).—Callender's Cable & Construction Co., Ltd.

Rotherham.—Board of Guardians. Accepted :—
Electrical sundries.—Lilleker Bros.

Forthcoming Events.

Brighton Corporation Electrical Exhibition.—The Dome, Brighton. October 10th to 19th.

Institution of Engineering Inspection.—Friday, October 11th. Royal Society of Arts, John Street, Adelphi, W.C. 5.30 p.m. "The Chemical Laboratory in Inspection." Mr. E. F. Law.

Junior Institution of Engineers.—Friday, October 11th. 39, Victoria Street, S.W. 7.30 p.m. "Coal and Coal Cleaning." Mr. R. H. Allen.

Nottingham Society of Engineers.—Friday, October 11th. Mechanics' Institution, Nottingham. 7.30 p.m. Annual general meeting.

Institution of Engineers and Shipbuilders in Scotland.—Friday, October 11th, Grosvenor Restaurant, Gordon Street, Glasgow. "James Watt" dinner.

Association of Mining Electrical Engineers (South Wales Branch). — Saturday, October 12th. At Treforest. "Cotton in Engineering." Mr. J. B. J. Higham.
(Western Sub-Branch).—Saturday, October 12th. Swansea. Address by the chairman, Mr. S. T. Richards.

Institute of Transport.—Monday, October 14th. Institution of Electrical Engineers, Victoria Embankment, W.C. 5.30 p.m. Inaugural address by the President, Air Vice-Marshal Sir W. Sefton Brancker.

Association of Supervising Electrical Engineers.—Tuesday, October 15th. Junior Institution of Engineers, 39, Victoria Street, S.W. 6.30 p.m. Presidential address. Mr. S. B. Donkin.

Manchester Wireless Exhibition.—October 16th-26th. City Hall, Manchester.

Institution of Electrical Engineers, (Sheffield Sub-centre).—Wednesday, October 16th. Royal Victoria Hotel, Sheffield. 7.30 p.m. Address by the Chairman, Mr. H. W. Walker and smoking concert.
(North-Eastern Students' Section).—Friday, October 11th. Armstrong College, Newcastle-on-Tyne. 7.15 p.m. Inaugural address by the chairman, Mr. V. A. H. Clements.
(Western Centre).—Monday, October 14th. South Wales Institute of Engineers, Cardiff. 6 p.m. Chairman's inaugural address by Mr. S. B. Haslam.

Overhead Lines Association.—Wednesday, October 16th. Institution of Electrical Engineers. Annual general meeting. 5.30 p.m. Discussion on "Wayleave Agreements."

Institution of Mechanical Engineers.—Thursday, October 17th. Annual dinner. Friday, October 18th. Institution, Storey's Gate, S.W., 6 p.m. Presidential address by Mr. D. Adamson.

British Institute of Radiology, incorporating the Röntgen Society.—Thursday, October 17th. 32, Welbeck Street, W. 8.30 p.m. Ordinary meeting.

International Motor Show.—October 17th-26th. Olympia, W.

Birmingham Electric Club.—Friday, October 18th. Grand Hotel, Birmingham. 7 p.m. Ladies' night.

British Electrical Development Association. — Friday, October 18th. Royal Society of Arts, John Street, Adelphi, W.C. 7.30 p.m. "Personal Salesmanship in the Electrical Industry." Miss G. Burlton.

Electrical Power Engineers' Association (Southern Division).—Saturday, October 19th. Hotel Cecil, Strand, W.C. 5.30 p.m. Annual dinner.
(Glasgow Section).—Friday, October 11th. "A.c. Meters." Mr. R. J. Rennie.
(Manchester Section). — Saturday, October 12th. Cheetham Town Hall. 6.30 p.m. Social evening and dance.

The Batti-Wallahs' Society.

The next luncheon of this Society takes place on Thursday, November 7th, at 12.30 for 1 o'clock p.m. Mr. Frank Hodges will deliver an address.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following :—

Ancilla help-mate fire bars.

Saxonia electric meat chopper.

We also have an inquiry for the name of a wireless firm using as trade mark the letters "E" & "L" separated by a cross.

Notes.

Physical Society Exhibition.

The twentieth annual exhibition of electrical, optical, and other physical apparatus is to be held by the Physical Society and the Optical Society on January 7th, 8th and 9th, 1930, at the Imperial College of Science and Technology, South Kensington, London. As on previous occasions, there will be a trade section and a research and experimental section, and, in addition, a new section for the work of apprentices and learners is to be introduced. The Exhibition Committee invites offers from research laboratories and institutions, and from individual research workers of exhibits suitable for inclusion in any of the above three groups. Offers of exhibits, giving particulars of space and other facilities required, should be communicated not later than October 30th to the Secretary, Exhibition Committee, 1, Lowther Gardens, Exhibition Road, London, S.W.7.

Diesel Engine Users' Association.

Before a well-attended meeting of the Diesel Engine Users' Association on October 4th, Mr. Gerald B. Fox read a paper on "Indicating Oil Engines." Beginning with the manipulation of the indicator, he described the adjustment and cleaning thereof for use, the arrangement of the drive, the actual taking of the diagram, and concluded by describing a few types of indicator, including the "Mathot," "Gale," Farnboro," and optical indicators. A keen and interesting discussion followed, in which a number of members and visitors participated.

Overhead Lines Association.

At the conclusion of the formal business of the annual general meeting of the Association on October 16th, a discussion will take place at the Institution of Electrical Engineers, London, at 5.30 p.m., on the subject of wayleave agreements.

Fatality.

At Dunfermline on October 3rd the circumstances of the death of a colliery fireman, who received a fatal electric shock while working in the No. 2 Pit of Mossbeath Colliery, Cowdenbeath, were inquired into. A work mate said he saw sparks coming from an electric motor driving a fan, and found deceased lying at the machine. Robert Cuthbert, an electrical engineer in the employment of the Fife Coal Company, said he put in the fan five days before the accident. It was in good condition at that time. In his opinion deceased must have touched a bare conductor, but this was not discovered until the machine was examined in the workshop, when Mr. Roberts, the Government Inspector, found a bare spot. David Middleton, foreman electrician, said that the fault which was discovered was not one which made the machine "live" at all periods, but only intermittently. Mr. J. A. B. Horsley, H.M. Electrical Inspector of Mines, said he saw certain portions of the machine, but he did not see the most vital part, because the stator had been rewound. He had come to the conclusion that the fan was mechanically defective at the time it was installed. He did not, however, associate the mechanical defect directly with the fatal accident. With regard to the electrical defects, his assumptions were that the insulation of the end-coils where it was pressed upon by the end bell was at several places brittle and fragile through age and usage. It was probable that there was temporary and intermittent contact between one of the bare places and the end bell, causing the motor casing and the fan casing to become "live" at the moment when deceased touched it. To the formal verdict the jury added that, in their opinion, the accident was due to a defect in the insulation of a coil of an electric motor.

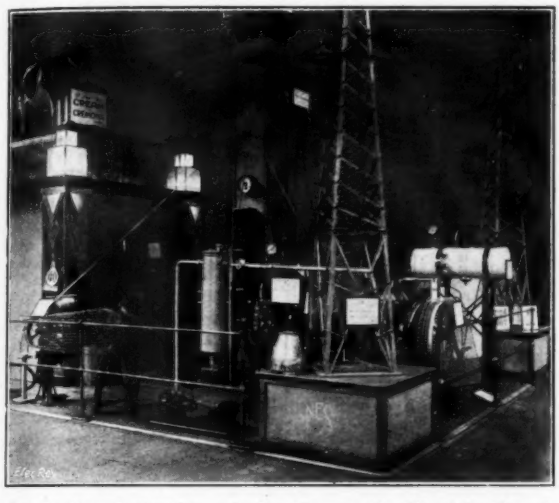
The Rationalisation of Industry.

Mr. A. P. Young, O.B.E., M.I.E.E., M.I.A.E., manager of the Rugby Works of the British Thomson-Houston Co., Ltd., is reading a paper on "Rationalisation of Industry," before the Rugby Engineering Society, on Wednesday, October 16th, at the Benn Buildings, Rugby.

North-East Coast Exhibition.

The Newcastle-upon-Tyne Electric Supply Co., Ltd., informs us that it has now been decided to continue the agricultural section of its stand (No. 550 in the Palace of Engineering) until the Exhibition closes on October 26th. The Company has, therefore, re-arranged the existing apparatus, and added a farmer's bench containing a small circular saw, by A. Ransome and Co., Newark, driven by a 3-h.p. motor; a small band saw by the same firm, suitable for cutting either wood or metal, and driven by a 1/3-h.p. motor; and a combined portable and bench drilling machine and vice.

The main addition, however, consists of a 55-gallon per hour



Agricultural Section of the Newcastle Electric Supply Co.'s Stand at North-East Coast Exhibition.

combined cooling and refrigerating plant, by the Wessex Refrigerating Plant, Ltd., by means of which the milk is cooled from 95 deg. F., at which temperature it leaves the cow, to 36 deg. F., when it is ready for bottling or filling the churns for sending to the retailer. This machine, which is driven by a 2½-h.p., three-phase motor, is causing a great deal of interest, as, even with the additional cooling by means of the refrigerant not be desired, the water-cooling portion will reduce the temperature of the milk to within 5 deg. of the cooling water. Further, the machine, by means of the three-way cocks provided, can be utilised for connection to cooling and cold-storage chambers.

The Exhibition of Inventions.

At the International Exhibition of Inventions, which has been held during the current week at the Central Hall, Westminster, under the auspices of the Institute of Patentees (Inc.), there are a number of exhibits of electrical interest. A range of electric lamp locks is shown by Messrs. J. A. Brook, including the "Klip-Lamplok." This is a simple, but effective, device for use with bakelite holders, and consists of a narrow semi-circular band which is sprung round the holder and clipped into the lamp-pin slots. This company is also exhibiting its "Super-sparker," which is fitted to the dashboard of a motor car and indicates ignition and carburation troubles whilst the car is in motion. The St. James's Electrical Co., is showing its patent electric mains bells for fire alarms, domestic, mines, and industrial purposes, and lamp signalling, indicating systems, and time-limit switches. Illuminated advertising letters form the feature of the display of Messrs. G. S. Walliker and Son. These are constructed on the open-trough system, but a distinctive feature is the concealment of the lamps within the letters, leaving a clear unbroken announcement on the surface. By this means it is claimed that better lighting is obtained with only half the number of lamps required for the system in which lamps are exposed. W. R. Patents, Ltd., is exhibiting a number of devices for the detection of explosive gases and vapours, including the "Ringrose" gas sentinel, gas operated electric cut-offs, and fire-damp alarms. The display also includes the "Ringrose" miner's safety lamp. The Sellers Super-Vacuum Cleaner, Ltd., is demonstrating its vacuum cleaners, and Mr. O. Overbeck is showing electric rejuvenators. Electrically-operated advertising devices and signs are exhibited by Mossops (London), Ltd.

The Association of Supervising Electrical Engineers.

The opening meeting of the 1929-30 session is to be held on October 16th at the Junior Institution of Engineers, Victoria Street, S.W. Mr. B. C. Garman, chairman of the Association, will preside, and Mr. S. B. Donkin, who has consented to act as president for a further term, will deliver his presidential address. The subject of the address will be "The Production of Power from Natural Sources other than from Fuel," and in the course of his remarks Mr. Donkin will make referencee to water power, tidal water power, with reference to the Severn barrage scheme, and wave power. He will also refer to what has been done in utilising power from the sun, giving results of tests on the only reasonably large plant ever put down for this purpose, and describing shemes by various inventors for obtaining power from the latent heat of ice, from the thermal energy in the sea, natural steam in volcanic districts, and from the earth's heat, &c.

Appointments Vacant.

Shift charge engineer for Croydon Corporation. Assistant engineer and clerk of works for Graylingwell Mental Hospital, Chichester. Fitter-driver for Severalls Mental Hospital. Boiler-house charge engineer for Singapore Municipality. Chief assistant electrical engineer for Aylesbury Corporation. Meter mechanic and tester for Darwen Corporation. Station superintendent for Scarborough Corporation. Wireman for Cannock Urban District Council. Resident engineer at Kirkstall power station for Leeds Corporation. Mains engineer for Winchester Corporation. Assistant engineer £300-£400) for the Electric Development and Securities Trust, Ltd. (See our advertisement pages to-day.)

The Paris Motor-car Show.

One of the novelties of the Paris motor-car show, which was opened on October 4th, was the 8-cylinder Duesenberg car, an American product that is said to be capable of developing 265 h.p. It is fitted with electric indicating lamps on the dashboard, to tell the driver when and how the lubricating system and the battery are functioning. Another car has an electromagnetic gear-changing device for altering the back-axle ratio; it has an ordinary 3-speed gear box as well, so it has six gear ratios in all. The car is made by the Voisin Co.

The Battersea Power Station.

At a meeting of the Chelsea Borough Council held on October 2nd, the report of the special committee appointed by the Council in connection with the proposed Battersea power station was read. The report stated that on September 26th a deputation was received by the Minister of Health and the Minister of Transport from the borough councils concerned and from the authorities of Westminster Abbey. The deputation was informed by the Minister of Health that the Government had had under consideration the question of the Battersea power station since it came into office, and was unwilling to take any action likely to cause damage in any scheme. The Minister stated that up to he present no report had been received concerning the claim of the London Power Co. to have discovered a solution to the sulphur problem, but he assured the deputation that unless the Government was satisfied by its chemists that there would be no danger in this respect, the whole scheme would not be proceeded with. The Minister of Transport, who also spoke, said that quite rightly the local authorities affected were inquiring into the matter, but that it was his duty to do his utmost to secure an abundant supply of electricity at a cheap price. Concerning the proposed Fulham power station, the Minister added that the deputation could rest assured that consent to its erection would not be given unless the Government was satisfied that there would be no danger to health or to the buildings of London.

The 66-kV Grid System in London.

The B.I. Co. Laying 66-kV Cables in Regent's Park.

Edinburgh Electrical Society.

The syllabus of lectures for the 1929-1930 session contains the following:—October 23rd, "Electric Plant Repairs," Mr. J. Walker; November 6th, "Colour Lighting in Theatres, &c.," Mr. R. Gillespie Williams; November 20th, "Street Lighting," Mr. W. Millar; December 4th, "Static Condensers," Mr. H. Ferguson; December 18th, "Electric Traction," Mr. J. S. Ross; January 22nd, 1930, "Photo Electric Cells," Mr. H. C. Walker; January 24th, Whist Drive and Dance, Royal Arch Hall; February 5th, "Tele-Photography," Mr. W. P. Morris; February 19th, Apprentices' Night; March 12th, Annual General Meeting.

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(5) All underwriters' laboratories standard cords contain manufacturers' identifying marker threads as required by code and as given in Underwriters' List of Inspected Electric Appliances.

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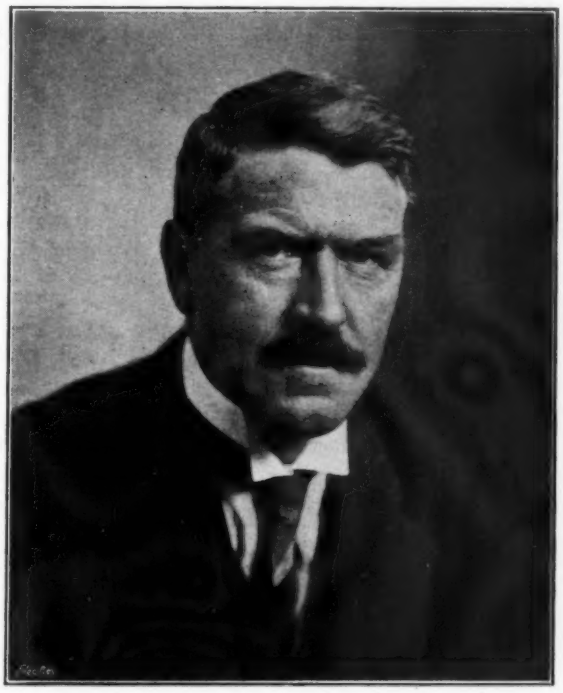

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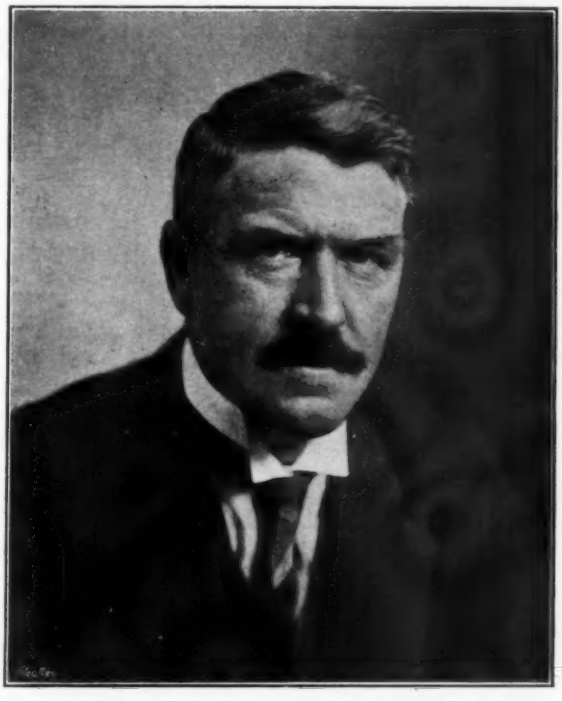

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Obituary.—Mr. H. Collinson.—The funeral took place on October 1st of the late Mr Herbert Collinson, partner in the firm of Collinson Bros., electrical contractors, Bradford. Mr. Collinson, who was only 47 years of age, received injuries, which proved fatal, owing to the slipping of a ladder whilst he was examining work on the new electric lighting installation which his firm had in hand at the Clayton Parish Church. Mr. Collinson was a member of one of the best-known electrical contracting firms in the Bradford district, and a lecturer in electrical engineering at the Bradford Technical College. He leaves a widow and four children. The funeral was attended by a large gathering of representatives of the Bradford and other Yorkshire branches of the Electrical Contractors' Association and other electrical bodies.

Mrs. J. C. Whitmoyer.—We learn with great regret that Mrs. Whitmoyer, wife of Mr. J. C. Whitmoyer, M.I.E.E., contracts manager of the Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, died suddenly on Tuesday, the 1st inst. We are sure that his many friends in the industry will desire to express their deep sympathy with him.

Dr. R. V. Hansford.—We regret to record the death, as a result of an accident on October 5th, of Mr. Richard Vernon Hansford, D.Sc., who, for the past 19 years had been in the Chief Engineer's Department of the General Post Office. In recent years Dr. Hansford was concerned with the development of wireless telegraphy and telephony and the success of the transatlantic telephone service was due to a great extent to his work. He was 41 years of age. The funeral took place at Bandon Hill Cemetery, near Waddon, Surrey, on Wednesday last.

Mr. W. Bannister.—We have to announce, with regret, that Mr. William Bannister, J.P., who was an original director of the Chloride Electrical Storage Co., Ltd., of which company he had been chairman for the past 27 years, died at his home at Croydon on October 1st, at the advanced age of 82 years.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Universal Consulting Patent, Ltd.—Private company. Registered October 1st. Capital, £200 in £1 shares. Objects: To acquire patents, rights, secret processes, licences, protections, and concessions; to manufacture machinery, and to carry on the business of mechanical, consulting, electrical and motor engineers, manufacturers of electric lamps and apparatus, motor-cars and accessories, &c. The first directors are:—J. N. Waring, 22, Grangecliffe Gardens, South Norwood, S.E.25; D. Krestin, 17, Culverley Road, Catford, S.E.6, engineer; T. E. Beaumont, address not stated; A. Swale, address not stated. Registered office: Aldwych House, Aldwych, W.C.2.

Philips Lamps (Ireland), Ltd.—Private company. Registered in Dublin on September 27th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of electricians, manufacturers of, agents for, and dealers in all kinds of electric lamps, including gasfilled lamps, &c. The subscribers are:—A. De Jong, 148, King's Avenue, London, merchant; D. C. F. Van Eendenburg, "Hindounid," Gloucester Road, Kingston-on-Thames. The first directors are not named.

Safac Accumulator Co., Ltd.—Private company. Registered October 2nd. Capital, £500 in £1 shares. Objects:—To carry on the business of manufacturers of and dealers in accumulators, &c. The directors are:—J. Carlier, 221, Avenue de Tervueren, Brussels, Belgium; G. Gall, 9, Severn Avenue, Hare Park, Romford; G. Judd, 11, Earl Cottages, Earl Road, Bermondsey, S.E.; E. Lever, 12, Highbury New Park, N.5. Solicitors: W. R. Bennett & Co., 74, Great Russell Street, W.C.1.

Electric Central Heating and Ventilating Co., Ltd.—Private company. Registered in Edinburgh on September 28th. Capital, £20,000 in £1 shares. Objects:—To carry on the business of lighting, ventilating, heating, electrical and mechanical engineers, &c. The directors are:—G. B. Burnside, 104, Buchwood Drive, Glasgow, mechanical engineer; W. B. Hutchinson, 4, Brownside Road, Cambuslang, electrical engineer. Registered office: 157, West George Street, Glasgow.

Emkabe Radio Co., Ltd.—Private company. Registered October 3rd. Capital, £100 in £1 shares. Objects:—To carry on the business of manufacturers of and dealers in wireless and electrical goods, &c. The directors are:—A. Fuchs and I. Falkenflieg, 19, Argyle Square, W.C. Secretary: A. Fuchs. Registered office: 47, Farringdon Road, E.C.1.

Hudson Radio, Ltd.—Private company. Registered October 4th. Capital, £100 in £1 shares. Objects: To carry on the business of engineers, advisers, experts and consultants, in connection with wireless, &c. The subscribers (each with one share) are: R. H. Currell, 79, Scott's Road, Leyton, E.10, clerk; C. H. Blazier, 11, Downhurst Avenue, Mill Hill, N.W., clerk. The first directors are to be appointed by the company or by the subscribers. Secretary: M. Marks, 65/6, Basinghall Street, E.C.

Automatic Light Control, Ltd.—Private company. Registered September 30th. Capital, £10,000 in £1 shares. Objects: To carry on the business of electrical engineers and contractors, mechanical engineers, manufacturers and repairers of and dealers in machinery, photographic, scientific, electrical, magnetic, galvanic, television, signalling and kinematography apparatus, &c. The subscribers (each with one share) are: F. W. W. Highfield, Ingleside, Warwick Road, Kenilworth, electrical engineer; H. Megainey, 17, Shaftesbury Road, Coventry, secretary. The first directors are not named. Solicitors: R. A. Rotherham & Co., 28, Bailey Lane, Coventry.

Electrotone Talking Pictures, Ltd.—Private company. Registered October 4th. Capital, £100 in 1s. shares. Objects: To carry on the business of manufacturers of and dealers in cinematograph films and apparatus of all kinds, to produce, exhibit or deal in films, either talking or silent, and in all apparatus or mechanism for manufacturing or exhibiting such films, and any device, mechanical, electrical or otherwise for synchronising films and vocal or other sounds, &c. The directors are: T. W. Meldrum, 1, Albemarle Street, W.1; G. L. Padley, address not stated. Solicitors: Boyce, Evans and Sheppard, 14, Stratford Place, W.

L. Cole & Sons, Ltd.—Private company. Registered October 4th. Capital, £500 in £1 shares. Objects: To carry on the business of engineers, advisers, experts, consultants, and contractors, &c., in connection with wireless telephony or telegraphy, &c. The subscribers (each with one share) are: R. H. Currell, 79, Scott's Road, Leyton, E.10, accountant's clerk; C. H. Blazier, 11, Downhurst Avenue, Mill Hill, N.W., accountant's clerk. The first directors are to be appointed by the company or by the subscribers. Secretary: M. Marks.

Radio Recordion, Ltd.—Private company. Registered September 30th. Capital £500 in £1 shares. Objects: To carry on the business of manufacturers, producers, importers, and exporters of, agents for and dealers in gramophones and phonographs either separate or combined with cinematograph, wireless and/or television apparatus, &c. The provisional directors are: H. B. Pritchard, 19, Kingsland, Newcastle-on-Tyne; W. Pritchard, Melkridge House, Haltwhistle, Northumberland; Dr. R. W. Simpson, 74, Jesmond Road, Newcastle-on-Tyne.

Official Returns of Electrical Companies.

Embleton & Barker, Ltd.—Capital, £1,000 in £1 shares. Return dated April 2nd, 1929. All shares taken up. £500 paid. £500 considered as paid. Mortgages and charges, nil.

Premier Wholesale Electric Co. (Stockport), Ltd.—Satisfaction in full on September 2nd, 1929, of mortgage dated September 29th, 1923, securing £330.

Tisbury Electric Supply Co., Ltd.—Capital, £6,000 in £1 shares. Return dated May 23rd, 1929. All shares taken up. £6,000 paid. Mortgages and charges, nil.

Western Electric Co., Ltd.—Capital, £20,000 in £1 shares. Return of allotments, made up to April 16th, 1929, shows all shares allotted, payable in cash, and fully called up. Mortgages and charges, nil.

Northleach Electric Supply Co., Ltd.—Capital, £3,000 in £1 shares. Return dated May 14th, 1929. 1,750 shares taken up. £1,800 paid (including £50 paid on 100 forfeited shares). Mortgages and charges, nil.

Oxford Electric Co., Ltd.—Capital, £350,000 in 150,000 6 per cent. preference and 200,000 ordinary shares of £1 each. Return dated May 3rd, 1929. All shares taken up. £316,000 paid on 150,000 preference and 166,000 ordinary shares. £34,000 considered as paid on 34,000 ordinary shares. Mortgages and charges: £110,000.

Dudley, Stourbridge & District Electric Traction Co,, Ltd. Capital, £200,000 in 20,000 preference and 20,000 ordinary shares of £5 each. Return dated May 14th, 1929. All shares taken up. £200,000 paid. Mortgages and charges: £103,140.

Wells, Rayner & Co. (1929), Ltd.—Capital, £2,000 in £1 shares. Return dated December 31st, 1928 (filed September 6th, 1929). 558 shares taken up. £558 paid. Mortgages and charges, nil.

Western Counties Electrical & Engineering Co., Ltd.—Two mortgages, dated September 21st and 23rd, 1929, to secure £3,000 and £350, respectively, charged on 18, Princes Street, Yeovil. Holders: Frome Selwood Permanent Building Society and A. M. G. Daniel, Frome.

C. J. Thursfield & Co., Ltd.—W. F. Alldritt and C. E. Ward, Sun Buildings, Bennetts Hill, Birmingham, were appointed receivers and managers, in substitution for the late W. E. Alldritt, on September 13th, 1929, under powers contained in debentures dated January 8th, May 13th, and October 10th, 1927.

Harry Morser & Co. (Wireless), Ltd.—H. E. F. Connolly, 10, Nutley Lane, Reigate, ceased to act as receiver or manager on September 25th, 1929.

City Notes.

Stock Exchange Notices.

Application has been made to allow the following to be officially quoted:—

W. & T. Avery, Ltd.—676,449 ordinary shares of £1 each, fully paid, Nos. 1 to 676,449; 26,846 5 per cent. "A" cumulative preference shares of £5 each fully paid, Nos. 1 to 26,846; and 147,128 5½ per cent. "B" cumulative preference shares of £1 each fully paid, Nos. 1 to 147,128.

Chloride Electrical Storage Co., Ltd.—395,550 "A" ordinary shares of £1 each fully paid, Nos. 62,001 to 457,550; 111,655 "B" ordinary shares of £1 each fully paid, Nos. 457,551 to 569,205; and 62,000 6 per cent. cumulative preference shares of £1 each fully paid, Nos. 1 to 62,000.

Dealings in the following have been allowed by the Committee under Rule 159:—

Underground Electric Railways Co. of London, Ltd.—4,710 ordinary shares of £1 each, fully paid, Nos. 7,230,053 to 7,234,762.

Folkestone Electricity Supply Co., Ltd.

We briefly reported in our last issue that the acquisition of the company's ordinary capital by the County of London Electric Supply Co., Ltd., would be effected by an exchange of shares. The basis of the exchange will be five ordinary "County" shares for each four Folkestone shares. The County Company stipulates that the offer must be accepted by holders of 80 per cent. of the Folkestone Company's shares (or such less percentage as it cares to accept). The shareholders of the County Company have been asked to ratify the agreement on or before October 14th.

Vera Cruz Electric Light, Power and Traction, Ltd.

The report for the year ended December 31st, 1928, records a net profit in Mexico of £30,085. After deducting all expenses and service of debentures, and a debit balance of £17,693 brought forward from 1927, there is a debit balance of £7,422. The failure of the Vera Cruz Municipality to meet its bills for public services is seriously affecting the profits.

Stothert & Pitt, Ltd.

A dividend of 10 per cent. is recommended, against 6 per cent. last year.

Oriental Telephone and Electric Co., Ltd.

An interim dividend of 4 per cent., free of tax, has been declared on the ordinary shares.

North Metropolitan Electric Power Supply Co.

An interim dividend of 4 per cent. has again been declared on the ordinary shares, payable on November 15th.

Callender's Cable & Construction Co., Ltd.

The interim dividend on the ordinary shares is again 5 per cent.

Stocks and Shares.

Tuesday Evening.

The effects of the high Bank Rate and the aftermath of the Hatry group collapse are still potent factors in Stock Exchange affairs. Added to this, there was at the end of last week a violent shake-out in the prices of the American utility shares which have been soaring, apparently without limit, and whose upward flight became abruptly checked by a wave of selling that caused severe falls. Some prices have gone back as much as 50 points from the best recently touched. One seller tends to make many others, and, with the New York market thrown into a thoroughly nervous condition, the repercussion on this side made an added element of disturbance at a time when our own markets were far from ready to stand any further shocks after the two mentioned in the opening lines above. The violence of the fall had the usual effect of bringing in both bears and bargain hunters, with the result that the lowest prices did not prevail for long, but were succeeded by a fairly substantial recovery.

Money Matters.

The Bank Rate of 6½ per cent. is not expected to be exceeded, in view of the satisfactory way in which foreign exchanges have shown a disposition to become more normal, the outstanding exception being that of France. According to arrangements at present in force, the settlement in connection with what are called the Hatry shares is postponed, from October 24th, to a date not yet fixed. This is due to the difficulties encountered in the unravelling of the many knotty points at issue. Until the settlement in these stocks and shares is out of the way, there is bound to be a certain amount of nervousness in regard to the length to which ramifications of the collapse may have extended. New issues find favour, however, where they offer good security and a reasonable rate of return. A line of new 6 per cent. preference shares in the Shropshire, Worcestershire & Staffordshire Electric Power Company recently came to market, and buyers readily took them at a guinea and thereabouts.

Folkestone Electric Acquisition.

Mention was made here last week of the acquisition by the County of London Company of the Folkestone Electric Company. Official details show that the offer of the County Company represents the exchange of five of its shares for four of the Folkestone Electrics, this basis guaranteeing to the Folkestone proprietors the same amount of dividend as they have been receiving from their own undertaking. The financial effect was to make Folkestones worth something like 70s., taking County of London at 57s., and the prices became adjusted, Folkestones rising to the former figure, and County of London going back to 54s. 6d. Some of the Folkestone shareholders elected to take their profit before the amalgamation was formally completed, with the result that the prices gave way to 66s. 3d., which is ex dividend. The announcement led to speculation as to what is likely to be the next company that will attract the attention of the County of London, and a rise in Isle of Thanet shares to 39s. is an indication of what is hoped may materialise in the future.

It may not do much harm to mention now that the offer of the County of London Company was not the first that the Folkestone Electric had received. Some time ago, the Folkestone board was approached by another group with a view to negotiating for a purchase of the Folkestone undertaking, but the terms offered at that time were not considered sufficiently attractive, and shareholders in the Folkestone Company owe their directors appreciation for awaiting that better offer which subsequent events have shown the board to be justified in expecting.

Electricity Supply.

Bournemouth & Poole are again 1/16 lower at 63/3. Midland Counties, Scottish Power, and Yorkshire Electrics show small declines. Lancashires can be bought for less than the middle price of 28s. On the other hand, Egham & Staines rose 1s. to 38s., and Northants 6d. to 48s. 3d. Newcastle and District ordinary are dull at 28s. 9d., the new shares being 27s. 9d. British Light & Power continue to be neglected. The price is 15s. 6d. Atlas, at 26s. 9d., have shed 3d. The prevailing tendency in this department is dullish. Perak Hydro-Electric ordinary shares drooped to 15s.

Cables and Wireless Stocks Recover.

The flatness which for some time past has characterised the stocks of the Cables & Wireless Company gave way to a more cheerful disposition, owing to speculative purchases of the company's "B" ordinary stock. It will be remembered that the price fell from 100, touched last July, to 55 some ten days ago. Probably it was premature to pay anything like three figures for the stock, but at 55 speculation can reasonably hope for an advance in the price on prospects. The position is that though the "A" ordinary stock is not likely to get the full 7½ per cent. to which it is entitled during the first year of working, the proper amount should be earned in the second year, and this would bring into nearer vision the chance of the "B" stock receiving a distribution within the course of the next three or four years. This "B" stock represents the equity of the Cables & Wireless business, and it is with this

that speculation is chiefly concerned. Meanwhile, the 7½ per cent. "A" ordinary stock is a sound speculative investment at anything like the present figure of 82½. Purchasers should be content to look for no more than 5 per cent. out of the first year's working. After that, the dividend, as already mentioned, should improve steadily.

Home Rails.

The Home Railway market has made an effort to participate in the general improvement which set in at the early part of this week. Several of the steam companies' stocks advanced, and the Undergrounds were able to shake off their recent depression. The strike of a few hundred London General Omnibus men was quickly settled, and the Underground Electric Railways issues, which had given way, recovered to a slight extent, the £1 shares to 22s. 6d., the income bonds to 106. Metropolitan consolidated more than regained its previous loss, and spurted to 61. Districts are 72½, or 30s. higher than the prices of Central London assented ordinary, preferred ordinary and deferred ordinary stocks. Of the company's unassented issues, the prices are 71, 59½, and 77½, respectively.

American Utilities.

Amongst the more familiar stocks and shares of the American utilities group, the losses have been mild, as compared with the slump sustained by certain of the kerb market favourites. A drop of 7 points (less 60 cents dividend deduction) has left the price of Montreal Light & Power at 167½, which still means a net gain of 9 points within the past fortnight. Shawinigan Water is down no more than 1½, at 104½. Power Corporation of Canada fell 6 to 120½. Pennsylvania Light and Power rallied to 96, after having been 93¾. Consolidated Gas and Electric, of Baltimore, has gone back to 135½. Hydro-Electrics, pursuing their zigzag career, came down from 83½, at which they stood ten days ago, to 70 last Thursday. New York bulls took them in hand, and rallied the price to 74½. International Holdings are better on the week, at 10¼. Brazilian Tractions show no net change at 72, but the price has been considerably lower in the week's interval; the 6 per cent. preference maintain their advance to 240.

Tramway Shares.

Para Electric Railways & Lighting ordinary shares have gone back to 4s., and both classes of preference weakened to the common price of 13s. 9d. Anglo-Argentine Tramways preferences, first and second alike, are lower at 3 1/16 on sales probably made to meet obligations incurred in other directions. La Plata Trams are nominally 2s. 6d. middle. The last transaction recorded in them was at 2s. 0¾d., three weeks ago, the 6 per cent. preference changing hands at 20s. 9d. about the same time. Trifling improvements took place in certain of the London companies' shares. London & Suburban preference hardened a few pence, to half a guinea, and the ordinary are slightly firmer at 2s. 6d. Potteries' preference fell back to 7s. 6d. Llandudno & Colwyn Bay Electric Railway ordinary are something of a curiosity, the official quotation being "0 to 2s." No shares are recorded as having changed hands since June, 1927, when business was marked at 1s. 1d. They are £1 shares, fully-paid, and last received a dividend in April, 1923.

Manufacturing and Equipment.

Reactions, mostly extremely modest, have occurred in some of the manufacturing shares that recently enjoyed handsome rises. Amongst others which are easier may be mentioned Henleys, Callenders, Enfields and British Insulated. Brush ordinary keeps heavy at 130, British Aluminium weakened to 2½. Associated Electrical Industries to 38s. 9d.; General Electrics retained their price, at 52s. 6d. Crompton Parkinson ordinary, after their sharp fall last week recovered 1s. and now stand at a guinea. The new shares issued at 10s, fell to 9s. 6d. and rallied to 10s. 6d. Ever-Ready shares, at 19s., are a shade better than they have been; Ever-Ready Trusts are quoted somewhat nominally at 15s. Until the Trust has published the result of its first year's working, no particular change is to be expected in the condition of the market. Of the iron and steel shares, Babcock and Wilcox receded 1/16 to 63s. 9d., the interim dividend of 7 per cent, actual and tax-free, having no influence upon the price. Vickers went back to 8s. 3d. before hardening to 8s. 7½d. The rubber share market, after being heavy and dispirited, took a turn for the better, upon a small rise in the price of the raw material.

Telephones and Telegraphs.

Marconi Marines have made further downward progress, being again 2s. 6d. lower, at 52s. 6d.; Canadian Marconis are 31s. Oriental Telephones have dropped back to 58s. 9d. Venezuela Telephones changed hands a week ago at 26s. 6d. Great Northern Telegraphs are 10s. down at 30½. The shares of the Holding Company are being dealt in on the basis of 8¼. Western Union Telegraph stock marked at 215 on October 2nd. A fall of 2 in Anglo-American Telegraph preferred, to 101, is due to monetary conditions. Small losses have lowered American Telephone and Telegraph to 300, International Telephones to 125. The extending use of the dialling system fails to affect the price of Automatic Telephones, which keeps about 37s. 6d. Business in these, as in International Automatic Telephones, is very quiet.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Approx. Dividend. 1927.	1928.	Price Oct. 8 1929.	Rise or fall	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	63/3	—1/8	4 15 0
Brompton Ordinary	1	8½	8½	26/-	—	5 7 8
Charing Cross Ordinary	1	8½	8½	26/6	—	5 5 8
do. do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8¾	8¾	25/-	—	5 12 0
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref.	1	6	6	22/-	—1/-	5 9 1
Clyde Valley	1	8	8	36/3	—	.. ..
County of London	1	7	10	54/6	—3/-	3 13 6
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Edmundson's 7% Pref.	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation	1	11	11	52/-	—	4 4 8
Kensington Ordinary	1	8	8	36/-	—	5 7 8
Lancs. Light and Power	1	7½	7½	28/-	—	5 7 9
London Electric	1	8½	9	27/6	—	5 1 10
Metropolitan	1	9	9	46/3	—	3 17 3
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	6½	33/6	—1/-	3 17 7
Mid. Elec. Power	1	15	8	35/-	—1/2	4 11 5
Newcastle-on-Tyne Ordinary	1	6	6	26/8xd	—	4 11 5
do. 7% Pref.	1	7	7	25/-	—6d.	5 12 0
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref.	1	6	6	21/6	—1/-	5 11 8
St. James' and Pall Mall	1	8	8	26/6	—	5 5 8
Scottish Power	1	8	8	31/-	—6d.	5 3 3
South London	1	8½	8½	26/6	—	5 5 8
Urban Ordinary	1	7	7	38/3	—	3 13 6
Westminster Ordinary	1	8½	8½	25/6	—	5 9 10
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	23/9	—	6 6 4
Yorkshire Elec.	1	8	8	36/-	—6d.	4 9 0

Home Rails.

		Nom.	Approx. Dividend. 1927.	1928.	Price Oct. 8 1929.	Rise or fall	Yield p.c.
		£					
Central London Ord. Assented	Stock	4	4	71	—	5 12 8
Metropolitan	"	8	8½	61	+2½	5 17 8
do. District	"	4	5	72½	+1	6 10 10
Underground Electric	£1	5	7	22/6	+6d.	6 4 5
do. do. Income	Bonds	6	6	106	+1	5 13 2

Telegraphs and Telephones.

		Nom.	Approx. Dividend. 1927.	1928.	Price Oct. 8 1929.	Rise or fall	Yield p.c.
		£					
Anglo-Am. Tel. Pref.	Stock	6	6	101	—2	5 18 10
do. Def.	"	1½	1½	24½	—	6 4 5
Automatic Telephone	1	10	12½	37/6	—	6 13 4
Cables & Wireless 5% Pref.	Stock	—	—	92½	—	5 19 0
do. A 7½ Ord.	"	—	—	82½	—	... ...
do. B Ord.	"	—	—	58½	+1	... ...
Globe Tel. and T. Ord.	10	10	10	25	—	*3 18 6
do. do. Pref.	10	6	6	10½	—	5 9 1
Great Northern Tel.	10	20	17½	30½	—½	5 14 9
Indo-European	25	10	10	47½	—	*5 5 3
Marconi-Marine	1	12½	15	22	—½	5 14 2
Oriental Telephone Ord	1	12	12	21/3	—1/6	... ...

Home and Foreign Trams, &c.

		Nom.	Approx. Dividend. 1927.	1928.	Price Oct. 8 1929.	Rise or fall	Yield p.c.
		£					
Anglo-Arg. Trams First Pref.	5	5½	5½	8/1/6	—1/6	8 19 6
do. do. 2nd Pref.	5	6	6	8/6	—1/6	9 16 0
do. do. 5% Deb.	Stock	5	5	75	—	6 13 4
British Electric Traction Def. Ord.	"	5	5	160	—	... ...
do. do. Pref. Ord.	"	8	8	129½	+1	6 11 9
Brazil Traction	100	7	8	72	—	2 15 7
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	£6½	—	5 15 7
London & Sub. Trac. 5% Pref.	1	Nil	Nil	10/6	+6d.	... ...
London United Tram Deb.	Stock	4	4	51½	—	7 15 4
Mexico Trams, 5% Bonds	—	5	5	75½	—	6 12 5
Mexican Light Common	100	Nil	Nil	117½	—9	... ...
do. 7% Pref.	100	7	7	80½	—	8 8 8
do. 1st Bonds	—	5	5	78	—	6 12 5
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

Manufacturing Companies.

		Nom.	Approx. Dividend. 1927.	1928.	Price Oct. 8 1929.	Rise or fall	Yield p.c.
		£					
Assoc. Elec. Ord.	1	6	—	38/9	—1/8	3 2 0
Babcock & Wilcox	1	13	15	63/9	—1/16	*4 14 2
British Aluminium Ord.	1	10	10	50/-	—9d.	*4 0 0
British Elec. Transformer Pref.	1	7	7	13/-	—	... ...
British Insulated Ord.	1	15	15	4	—1/8	3 15 0
Brush Ord.	Stock	10	10	130	—	7 13 10
Callenders	1	15	15	8/15/16	—1/16	3 16 2
do. 6½% Pref.	1	6½	6½	1½	—	5 4 9
Crompton Parkinson Ord.	5/-	—	30	21/-	+1/-	7 2 0
do. 8% Pref.	1	8	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	7 1 3
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	7½	5½	15/-	—	7 6 8
Enfield Cable Ord.	1	20	20	5	—½	4 0 0
English Electric	1	Nil	Nil	8/3	—	... ...
do. do. Pref.	1	8	Nil	8/9	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	10	10	2/8	—	3 16 2
Henley	1	25	30	6½	—½	4 12 4
do. 4½% Pref.	5	4½	4½	4/2	—	5 6 0
India-Rubber	1	Nil	Nil	12/6	—	... ...
Johnson & Phillips	1	10	—	2	—	5 0 0
Siemens Ord.	1	7½	7½	28/9	—	5 4 4
Telegraph Construction	12	10	10	23	—	5 4 2

* Dividends paid free of Income Tax.

Electrical Imports of New Zealand.

The Figures for 1927 and 1928 Compared.

THE following table shows the values of electrical and allied goods imported into New Zealand in 1928, according to the recently-issued official trade returns. The figures for 1927 have been given for purposes of comparison, and notes of increases or decreases added :—

	1927. Thous.	1928. Thous.	Inc. or dec. Thous.
Electric batteries and cells—	£	£	£
Total	151	162	+ 11
From United Kingdom	37	44	+ 7
,, United States	93	65	– 28
,, Canada	19	48	+ 29
,, Denmark	1	1	—
Generators, motors and transformers—			
Total	518	486	– 32
From United Kingdom	320	327	+ 7
,, United States	89	94	+ 5
,, Sweden	31	23	– 8
,, Canada	17	12	– 5
,, Belgium	2	1	– 1
,, Germany	40	12	– 28
Insulated cable and wire—			
Total	520	375	– 145
From United Kingdom	485	346	– 139
,, United States	7	4	– 3
,, Australia	3	1	– 2
,, Canada	10	5	– 5
Electric lamps (incandescent filament)—			
Total	154	176	+ 22
From United Kingdom	100	117	+ 17
,, Netherlands	29	35	+ 6
,, United States	17	17	—
,, Austria	2	3	+ 1
Other electric lamps—			
Total	27	22	– 5
From United Kingdom	4	4	—
,, United States	17	12	– 5
Carbons in blocks, &c.—			
Total	23	19	– 4
From United Kingdom	14	13	– 1
,, United States	6	5	– 1
,, Australia	1	1	—
Insulators—			
Total	*	20	—
From United Kingdom	*	15	—
,, United States	*	3	—
Wireless sets in cabinets—			
Total	*	34	—
From United Kingdom	*	3	—
,, Canada	*	3	—
,, Australia	*	3	—
,, United States	*	25	—
Telegraph and telephone material—			
Total	380	304	– 76
From United Kingdom	94	63	– 31
,, United States	178	73	– 105
,, Belgium	72	138	+ 66
,, Netherlands	12	15	+ 3
Other electrical material—			
Total	648	504	– 144
From United Kingdom	354	294	– 60
,, United States	125	87	– 38
,, Australia	22	20	– 2
,, Canada	82	74	– 8
,, Switzerland	11	10	– 1
,, Sweden	40	3	– 37
Electricity meters—			
Total	46	50	+ 4
From United Kingdom	43	38	– 5
,, United States	1	1	—
Recording and testing instruments and meters—			
Total	82	77	– 5
From United Kingdom	50	47	– 3
,, United States	25	22	– 3
,, Germany	3	3	—
Turbines, water—			
Total (All from United Kingdom)	18	24	+ 6

* Not specified.

Indian Electrical Notes.

By An Indian Correspondent.

The Tata Companies.

CONSIDERABLE interest is attached to the recent announcement that an agreement has been concluded between Messrs. Tata & Sons, Ltd., of Bombay, and an American syndicate whereby the firm of Tata will share with the American syndicate the agency of the Tata Hydro-Electric Power Supply Co., Ltd., the Andhra Valley Power Supply Co., Ltd., and the Tata Power Co., Ltd. The American Syndicate will have a half share in the agency, which will be converted into a private limited company. The arrangement will not affect the present proprietary rights of the three joint stock companies, but is merely meant to enlist the co-operation of experts in hydro-electric works in America. The Tata water power undertakings, intended to supply the city of Bombay and its surroundings, are the largest hydro-electric works in India. The total present demand for mills, tramways and railways, &c., in Bombay is about two-thirds of the total capacity of the triple works, which is 285,000 h.p., made up as follows :—Tata Hydro-Electric Supply Co., 70,000 h.p.; Andhra Valley Co., 60,000 h.p.; and the Tata Power Co., 155,000 h.p. A further potential source, called the Konya River project, has recently been investigated, which, when carried out, will make available a further 80,000 h.p. The energy of this triple installation is entirely derived from rainfall, averaging about 200 inches per annum, and stored, within the catchment areas.

The engineering works connected with the Tata power projects are situated at Lonavla, above the Bhor Ghat in the Western Ghats of the Bombay Presidency. The rainfall is stored in three lakes at Lonavla, Wlawan and Shirawta, whence it is conveyed in masonry canals to the forebay, or receiving reservoir. The power house is at Khopoli, at the foot of the Ghats, to which the stored water is conveyed through pipes, the fall being 1,725 ft. The present capacity of the plant installed here is 70,000 h.p., but the duplication of the pipe line and installation of additional machinery is under way. To develop the original scheme, a northward extension was undertaken, called the Andhra River project. A dam about ¼ mile in length and 192 ft. high was built across it. In this instance the draw-off point is 11 miles up-stream from the dam, at a level of 112 ft. above the lowest river bed. The water is taken through a tunnel 8,700 ft. in length, driven in solid trap rock through the scarp of the Ghats, whence it enters the pipes for a vertical drop of 1,750 ft. to the generating station at Bhiviri, which is about 17 miles from the Khopoli station. The scheme is designed to yield 100,000 h.p. in its full development, but its present capacity is 60,000 h.p. The latest development is the Tata Power Company's scheme, which came into operation last year. This is a southward development of the original scheme, and is known as the Nila-Mula project, owing to the fact that the waters of the Nila and Mula Rivers were dammed for the conservation of water for it. A 150-ft. dam closes the outlet from a catchment valley, which originally provided the sources of the two rivers which form a junction at the dam site. A 4,000-ft. approach cut and 15,000 ft. of tunnel lead the water to a pipe line descending to a power house containing five generating units driven by double overhung Pelton wheels operating on a static head of 1,640 ft. Four 30,000-kVA transformer banks step the voltage up to 110,000 for transmission over a double tower line to a receiving station at Dharavi in Bombay, where it is stepped down to 22,000 V for underground cable distribution in conjunction with the Andra Valley Company's supply. It is noteworthy that the three power schemes are interlinked, and a constant supply is thus ensured. Of the total capacity of the present three plants, only two-thirds is utilised, but an increase in load is anticipated owing to the electrification of railways in the Presidency, and it is thought that within the next ten years the whole of the surplus will be utilised.

South Indian Railway Electrification.

It has been announced that the South Indian Railway suburban electrification scheme has almost been completed on the Egmore to Madras Beach section, and will shortly be opened for traffic. The power will be supplied by the Madras Electric Supply Corporation, in the first instance, to two sub-stations being built at Egmore and Minambakkam.

Electricity in the United Provinces.

Progress in electrical development in the United Provinces is reported from Muttra, Jubbulpore, Agra, Allahabad and Lucknow. At Muttra underground mains have been installed and the total number of connections is 229. At Jubbulpore the erection of the second 1,000-kW turbine set is well in hand. The extensions of the building at Agra have been completed, and the 200-kW vertical oil engine is in course of erection, the underground cable having been completed. The U.P. Electrical Supply Company supplies electricity to Allahabad and Lucknow. At the latter town the erection of the first set transferred from the Allahabad Station has been completed and the plant put into commission. Two rotary convertors are also in operation, and extension of distribution mains is being carried out. At Allahabad the turbine plant and the mercury arc rectifier are working satisfactorily.

The National Radio Exhibition.

A commentary on the progress made by British manufacturers during the past year as revealed by the recent display at Olympia, London.

By ERNEST W. BRAENDLE, A.M.I.E.E.

THE organisers of the National Radio Exhibition this year are again to be complimented on the general arrangements made for, and evidently appreciated by, the crowds which flocked to Olympia from all sources. Their system of simultaneous supply of music to the individual stands was extremely useful in enabling one to compare readily the relative merits of the dozens of loud-speakers and loud-speaking equipment being demonstrated. The provision of individual studios for those exhibitors desirous of utilising their own programme of entertainment was also a happy innovation at this year's show.

It would be impossible to detail at reasonable length the multitude of interesting things on view, but it is hoped to be able to indicate the general progress made by manufacturers in the past year with possible brief references to one or two outstanding items.

It is interesting to note that the general tendency this year is towards a reduction in size of the individual components, and it is especially noticeable in the case of inductance tuning coils, which were previously tending to become unduly large. The general finish of components is good, and more attention is being paid to electrical detail.

Battery eliminator and charging equipment, both complete and in individual units, were fairly prominent features, and it is satisfactory to note that they are now being designed on more liberal and substantial lines. Mains transformers, smoothing chokes, and condensers are now available for almost any combination of input and output requirements. The increasing use of the Westinghouse " contact " rectifiers for both high and low voltages is very noticeable, as is the recent decrease in price of the individual units.

Except in details, there seems to have been little development in valve manufacture. Certainly there were all varieties of screen-grid, pentode, and the smaller types of valves, but no reasonably-priced power valve suitable for, say, 500 to 600 volts anode pressure and for direct operation off a.c. supply mains is yet available. Also, very little progress seems to have been made in the way of improved neon lamps and photo-electric cells.

Of the more serious type of set, designed for first-class reception of our local stations, there was little to be seen. With the exception of radio-gramophone sets, of which there were a great many, the general tendency seems to be for small, compact, multivalve, portable, semi-portable, and permanent sets, the last named often designed for direct operation off the domestic mains.

A very interesting entertainment, unfortunately only open to the trade, was a demonstration of the Baird system of television. A complete studio and operating room were arranged in such a manner that it was possible to see the artists, the operator, and the televisor receivers in turn by just moving the head. When we consider the early stage of its development, the lack of experimental facilities, and the general difficulty in this country of financing early experimental work of this type, the resulting demonstration was extremely good. The size of the reproduced image is very deceptive, since it is seen through a magnifying lens, but it is sufficiently large and has sufficient detail to provide an easily recognisable likeness of the transmitted image. The relative detail compares very favourably with that of the early broadcast transmission of speech and music in the days, so convenient to forget, when Capt. P. P. Eckersley used to run up and down the scale on the studio piano and inform us that we couldn't hear more than about two-thirds of it. It is, therefore, interesting to note that the B.B.C. is now giving experimental television broadcasts. Unfortunately, the B.B.C. realises that the average listener is not likely to agree passively to the loss of an hour of his alternative programme in aid of progress, with the result that these transmissions take place between 11 and 11.30 a.m. during the week, a time of little use to anybody except experts engaged on the work and a few enthusiasts with sufficient leisure.

The main feature of interest, at any rate from the public point of view, was loud-speakers, of which multitudes were to be both seen and heard. Since it is in this direction that the main development of the past year seems to have taken place, it may be of interest to criticise this aspect a little more fully.

The general trend of design for all types of loud-speaker has apparently been based on the public demand for bass, treble, and increased volume-handling capabilities, which, coupled with the demand for loud-speakers enclosed in large cabinets, has not tended to improve the overall quality.

There seems to have been very little development, from the point of view of quality, of the reed-driven type and, although some manufacturers have certainly increased their volume-handling capacity, one and all suffer from the familiar " cone " quality, and in no case do they approach the average moving-coil type. Serious resonances in the middle scale have to a certain extent been eliminated, but, since they have been replaced by others in both the bass and treble, the result is not altogether satisfactory. One type even goes so far as to employ a number of definite resonant points, presumably on the principle that a few more or less do not matter; although the effect is not very noticeable in the case of music of the dance variety, the tones of a speaking voice trip most definitely from point to point, providing a quite ludicrous effect.

The " Baker-Selhurst " and the " Celestion " coil-driven speakers are undoubtedly good for commercial productions, but in the majority the development of treble, or bass, or both, has been carried to a very illogical conclusion. Certain of the bigger exhibitors seem to be under the impression that their names are sufficient warranty for their products, and their moving-coil speakers, besides being extremely crude in the matter of finish, have every appearance of requiring nothing short of a complete power-generating plant to operate them.

In connection with coil-driven loud-speakers, the Telegraph Condenser Co., Ltd., exhibited a 500-microfarad electrolytic type of condenser, suitable for operating on a 40-volt d.c. supply, which should be most useful for eliminating " ripple " from the field windings; although the new condenser has a considerably increased factor of safety, the danger of suddenly breaking the field circuit cannot be sufficiently emphasised.

The B.B.C. exhibit was very disappointing, as compared with former years, as was the general lack of interest shown in the exhibition by manufacturers of transmitting equipment. There were, however, a few examples of 400- to 500-watt power-amplifier equipment for kinema and theatres on view.

On the whole, one left Olympia with the feeling that the Exhibition was not as satisfying as in previous years, although the impression may have been partly due to the simultaneous presence of the Engineering and Shipbuilding Exhibition in the adjoining hall. It is felt that a little more attention paid by both exhibitors and salesmen alike to the requirements of the man of moderate means would go a long way to improve the general atmosphere.

Notes on the Exhibits.

(*Concluded from page* 583.)

Hart Accumulator Co., Ltd.

Experience continues to demonstrate the advantages and popularity of the glass-container type of filament accumulator. Assembled in specially moulded pressed-glass boxes with sealed glass lids, "R.M.E." cells are fitted internally with moulded ribs, or grooves, extending almost to the bottom of the box; between them the plates rest, and thus the use of separators and bottom blocks is entirely obviated, and in consequence larger space is available. The provision of vaseline cups, which prevent the corrosion of the terminals, is yet another excellent feature.

The "R.A.O." type of high-voltage accumulator cells, having a capacity of 1,250 milliampere-hours, are contained in

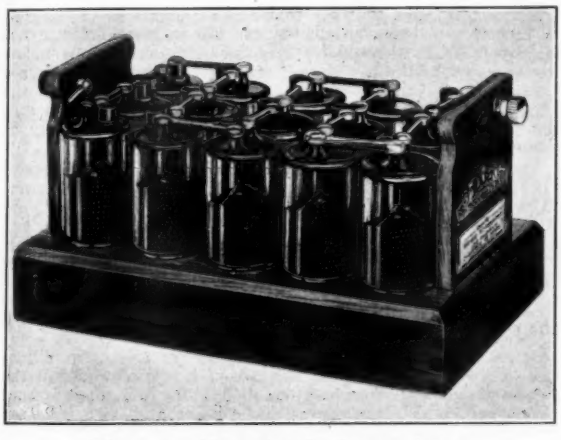

Fig. 13.—Hart Anode Accumulator.

moulded glass boxes, which are provided with grooved bottom rests into which the plates fit. The lid is of ebonite, sealed to the cell with compound, and when assembled into batteries the cells are connected to each other by means of connectors made from an alloy of non-corrodible metal. Both the positives and negatives are covered with sheets of perforated ebonite, which completely envelop the plates, thus minimising any dislodging of the active material from the grid structures. The circular glass boxes are also provided externally with a projecting rib which holds them in position upon a perforated tray. Fig. 13 illustrates a Hart "Radio" 30-volt, 3,000-milliampere-hour anode accumulator.

Burndept Wireless (1928), Ltd.

The company's series of receivers has been designed with three main objects in view · namely, to cover the wavebands specified by the Washington Convention for broadcasting stations throughout the world; to provide such selectivity as will be adequate for the requirements of the British regional scheme of stations; and to comply with the I.E.E. Regulations applicable to mains-operated sets. The new a.c. mains model receiver is original in design; it uses seven valves, two screen-grid h.f. stages, anode-bend detector, a r.c. stage with two super-power valves arranged for push-pull output, and a rectifier in the power unit. The receiver, together with an excellent loud-speaker and rotational frame aerial, is housed in a cabinet of fine finish. A single drum is used for tuning and a four-position switch brings into circuit wave-ranges of 200-330, 310-550, and 1,050-1,900 metres, and also arranges the instrument for gramophone amplification. The further controls are for volume and rotating the frame aerial. The instrument has a compact lay-out and is so designed that the complete chassis can be supplied for incorporation in customers' own cabinets if desired.

The "Ethogram" (model B) is, in point of fact, the same instrument, power unit, frame aerial, and loud-speaker, with the addition of an efficient electric gramophone motor; thus, the cabinet is slightly larger. A new "pick-up" is used, of the "needle armature" type. In order to avoid mechanical resonance, the ordinary armature has been done away with, thus ensuring that any resonant frequency set up will be outside the audible range. Such essential points as tracking angle, needle angle, pressure on record, and freedom from tone-arm resonance have been studied, and for that reason the device is sold only complete with a tone-arm.

The "Universal Screened Five" has been designed for the discriminating user who desires all-round performance; accordingly, no attempt has been made to reduce the number of controls. It is an open-aerial set and is supplied in two forms—for battery operation and direct from a.c. mains. The former utilises five six-volt valves, and a milliameter is included on the panel to enable any overloading of the output to be seen at a glance. The wave-lengths covered are 16-38, 220-560, and 850-2,100 metres; there are no coils to change, as the various ranges are brought into circuit by means of a special switch.

For powerful receivers and radio-gramophones the moving-coil loud-speaker generally finds most favour, but in other respects the new "Minstrel" speaker is attractive, for it requires no field current supply and its sensitivity is an advantage, as a large volume of undistorted sound is obtained with very moderate battery power applied to the receiver. Moreover, its two specially-treated linen diaphragms are carefully proportioned to give respond to the full range of musical notes, without unpleasant pronounced emphasis of any one. The movement is of the balanced-armature type, and a satisfactory adjusting screw is provided

The new screened portable set is new in design and has a better appearance and performance than the 1928-29 model. The case is made of small-grained imitation crocodile leather, finished blue, suitcase type; and all valves and batteries, although easily accessible, are covered by a panel; only the tuning controls protrude; drum controls are used, being calibrated direct in wave-lengths, and a new type of loud-speaker is used.

Edison Swan Electric Co., Ltd.

The combination of the three well-known radio manufacturing resources of the "Ediswan," B.T.-H. ("Mazda"), and Metro-Vick ("Cosmos") companies has resulted in the production of new lines. Their components are familiar to the public, and the new receivers are well made, of good appearance, and retail at attractive prices. Their safe and simple all-electric equipments are serviceable sets which dispense entirely with batteries. The all-electric a.c. transportable set is completely self-contained with a cone loud-speaker, and no batteries of any kind are used. Those who are unable to avail themselves of mains operation should consider the 3- and 4-valve battery models; they are powerful, simple to operate, and ensure a good standard of reproduction.

The 3-valve all-electric a.c. and d.c. sets are neat in appearance and easy to operate with the average loud-speaker. An important feature embodied in each set is the variable loose-coupled aerial tuning, which, in addition to ensuring selectivity, acts as a volume control. Each set is self-contained, and may be used in conjunction with an electrical pick-up for reproducing gramophone records; volume control for use with the pick-up is embodied. A variable choke feed is embodied, and the metal cabinets screen the circuits from hand-capacity effects.

In the case of a.c. mains-operated sets, all the valves employ a.c. for filament heating, the indirectly-heated cathode system being employed for screen-grid and detector valves, thereby eliminating ripple and consequent background noises. The eliminator employs a full-wave rectifying valve and is capable of correct adjustment to suit the voltage of the electric light mains. It is of the plug-in type, to facilitate easy replacement in the event of an alteration in supply conditions or voltages, due to change of residence or other causes. The set is fitted with a removable back, with interlocking plug, which provides a very efficient safety device, making it impossible to get access to the internal parts of the set until the supply has been disconnected. Each set is fitted with a fuse in the mains circuit, and is supplied with 20 ft. of flex with cord switch and adaptor for plugging into an ordinary lampholder.

In the self-contained d.c. set indirectly-heated cathode screen-grid and detector valves are used in the first two stages, a pentode being employed in the output stage. Insulation, which is so important on d.c. mains sets, is provided for, and a safety device consisting of an interlocking plug in the removable back ensures safety in operation. The loud-speaker is completely isolated from the mains by two condensers, and the aerial is definitely earthed to avoid mains interference on the negative side of a three-wire system, and to avoid any possibilities of short circuit or shock from the aerial itself.

Ferranti, Ltd.

This company's new Model 31 a.c. mains receiver is of quite small overall dimensions when it is considered that all the necessary battery eliminator components are incorporated in it. Its neat appearance will be judged from fig. 14. Except that a.c. mains valves are used, the circuit is generally similar to that of the company's screen-grid 3-valve set. One h.f. transformer-coupled screen-grid stage is followed by a grid-leak detector and one audio-frequency stage, the output being fed to the speaker through a suitable multi-ratio output transformer. The use of h.f. transformer coupling is an

unusual feature, transformers having been specially developed for the purpose. Astatic windings are used to avoid any tendency to self-oscillation, especially on the long waves. H.f. transformer coupling results in greater inherent selectivity, avoiding the necessity for critical action, and at the same time makes the receiver more easy to operate from the mains. Reaction is obtained by the differential method, which enables the capacity between the anode of the detector and earth to be kept constant, irrespective of the amount of reaction applied. This has the advantage of maintaining the efficiency of rectification under all conditions and at the same time of avoiding the variable loss of the higher audio frequencies, which undesirable cut-off, when it happens, is additional to that produced by very sharp tuning. The anode feed system, which has been largely developed by Ferranti,

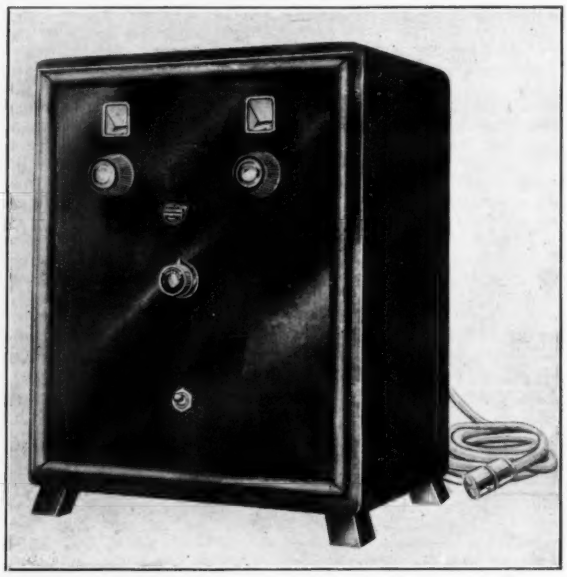

Fig. 14.—Ferranti A.C. Mains-driven Receiver.

Ltd., is incorporated, and prevents back coupling between the stages, which commonly produces whistles and generally poor reproduction. The system has the additional advantage of preventing the valves from being burnt out accidentally, for example, if there is a "short" inside the screened-grid valve. The set is designed for fitting in a polished wood cabinet of standard size, metal cabinets and panels having been deliberately avoided in view of possible danger in the case of receivers operated from the mains, and also because their use might be the cause of the accidental destruction of the valves.

Igranic Electric Co., Ltd.

An entirely new production, comprising a three-valve all-mains receiver employing screen-grid h.f. and pentode valves, was shown in table cabinets and in handsome bureau type, the latter incorporating electric gramophones and a newly-patented self-contained frame aerial.

The "Neutrosonic Seven" receiver was shown in its standard transportable form with combined battery box, frame aerial, and loud-speaker, and also in table and bureau cabinets.

The portable receiver "De Luxe" possesses interesting features which render it suitable for outdoor use and also for permanent use in the home. Two screen-grid valves are employed in the h.f. stages, and it is essentially a long-range portable receiver with the added merit of quality reproduction. An efficient receiver designed for short-wave reception only employs a screen-grid valve in the h.f. stage, and is capable of receiving from all parts of the world. Examples were shown of "all-mains" receivers, both two and three valve, for operation with outside aerials, and also "Igranophone" electrical reproducing equipment for domestic use and for use in kinemas, dance halls, &c.; single and double turntable units were exhibited, together with power amplifiers of various types. Transverse-current microphones and control units have been specially designed for use in conjunction with amplifying equipment used for band-repeating work. A wide selection of new mains units and battery chargers, together with such components as power transformers, smoothing chokes, potential dividers, &c., for the home construction of mains units was on view, and the dual-wave inductance coil is a new product of considerable interest; as its name implies, it is a dual-range coil covering both the normal and higher broadcast wavebands. The coils are enclosed in a neat bakelite casing, and it has been designed to take the place of the six-pin coil, but without the disadvantage of having to change coils, the change-over from one waveband to another being effected by means of a switch. Amongst other components may be mentioned especially the "Megostat," a variable high-resistance for use more particularly as a volume control, which is specially designed so that the resistance value remains constant under all conditions.

The "Pentoformer" is an output transformer specially designed for use with the popular pentode valve, and there was also a varied display of stand-off insulators, jacks and plugs, switches, "Indigraph" terminals and sockets, frame aerials, and absorption wave-meters.

Graham Amplion, Ltd.

Last year this company introduced the "Lion" cone-diaphragm loud-speaker. This season it has commenced to manufacture receivers for the first time. The four models are the 5-valve, 4-stage, a.c. mains set and the 4-valve, 4-stage, battery set, both of all-metal construction, with provision for the use of a gramophone pick-up. The 6-valve, 5-stage, a.c. cabinet set is self-contained with an aerial supported within hinged box panels at the sides of the speaker cabinet. The radio-gramophone is a similar handsome instrument, incorporating an electrically-driven turntable and "Electravox" pick-up. The a.c. sets make use of British Westinghouse metal rectifiers and comply with the I.E.E. safety rules; all have wavelength ranges of 200 to 560 and 1,000 to 2,000 metres, with a change-over switch. Screen-grid h.f. valves are utilised, and the last two super-power l.f. valves operate in parallel, allowing a dissipation of 10 watts.

The sets are not difficult to control, the drum-type dials being calibrated in wavelengths, and their selectivity is ample for the requirements of the "Prague plan," *i.e.*, station separation of 10 kc. They are said to have been produced to convince the sceptic and to do justice to the AB.6 and "Lion" speakers, and Mr. P. K. Turner is certainly to be congratulated on their design and lay-out, which are of a thoroughly engineering character. The power of the mains-driven sets is such that the music of an orchestra of some 20 performers can be reproduced at its original strength, if required; while the quality is such that distortion is below the observable limit. Notes are reproduced as they are broadcast, and all notes from E below the bottom A of the piano (*i.e.*, frequency 20) to C, over an octave above top C of the piano (*i.e.*, frequency 8,700), are reproduced equally so far as the human ear is capable of judging.

The circuit is in most respects quite normal, but several interesting devices have been incorporated. For instance, in order to avoid detector distortion, it is necessary to leave the l.f. amplification fixed; accordingly, both volume and selectivity controls are obtained by varying the aerial coupling. When designing the coupler, care was exercised to avoid possible coupling between the long- and short-wave coils, and so within the short-wave coil a small condenser has been placed to compensate for any difference between the self-capacities of the two coils. The long-wave coil is made with special wire having a quadruple covering, to obtain the best air spacing, while the use of reaction to widen the power range and sharpness justified a fairly high-resistance anode coil, which also saves space; actually two coils are employed, in parallel with negative coupling for short waves and in series with positive coupling for long ones. The unorthodox method of obtaining selectivity partly by reaction

Fig. 15.—"Amplion" A.C. All-metal Receiver.

and partly by the loose-coupled aerial circuit has unexpected advantages, making the sets both easy and interesting to operate; it necessitates very careful reaction arrangement, but the sets are well screened.

Perhaps the most unusual feature is the use of grid rectification in place of anode bend, for quality rather than selectivity, and the designer claims to have proved his preference. The all-metal construction of the sets frees them from "hand effect," while internal screening and the use of filters to prevent h.f. feed-back assist stability. The drum-drive condenser assembly is noteworthy, and the combined wave-range and gramophone switch is of a new well-made universal pattern.

The final result is illustrated in figs. 15 and 16, which show the a.c. receiving set and a set of curves that indicate the comparative output the set is capable of when supplied with

a carrier (actually at about 300 metres) modulated with a pure note of varying audio-frequency. Curve A was plotted at low selectivity, *i.e.*, strong aerial coupling without reaction. The dotted line shows a drop of 6 T.U., the least perceptible falling off for a normal ear; the middle part of the curve represents 100 per cent., and it will be appreciated that no

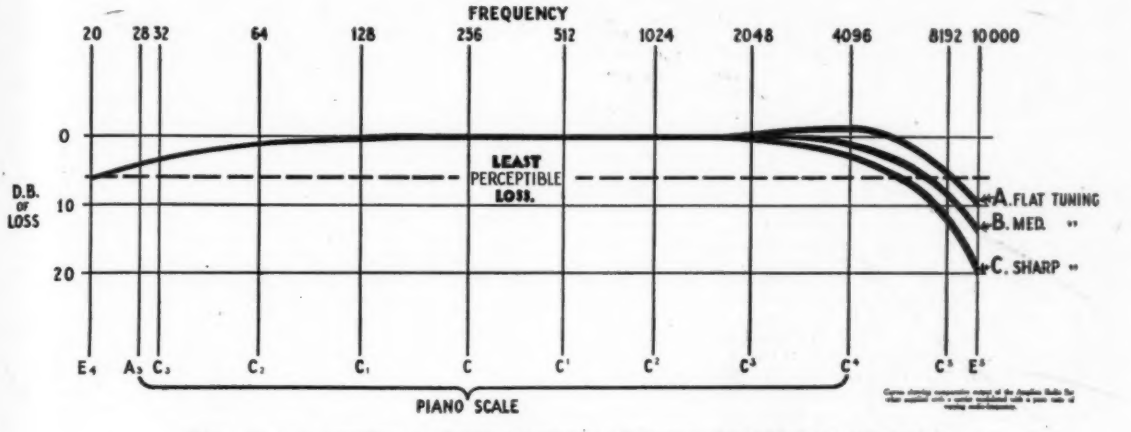

Fig. 16.—" Amplion " Radio-telephone Receiver Performance Curves.

perceptible loss in the bass is indicated till 20 cycles is reached (the lowest note of the piano is 28 cycles); the first perceptible loss in the treble is indicated at 8,600 cycles, above the range of most broadcast transmitters. To plot Curve B the sharpness of tuning was increased ten times and the amplification three times, by reaction and coupling adjustment, the effect on the extreme treble being obvious: the first loss occurs at 7,700 cycles, instead of 8,600, and for this reason the amplifier was designed to " hump " at 5,000 cycles as shown in curve A. The extreme condition is represented by Curve C, when the sharpness had been increased one-hundred fold and the strength ten fold; nevertheless, loss only becomes perceptible above 7,000 cycles. It is claimed that such results as those indicated above are " unapproached by anything else on the market," a big claim which we hope will justify the expenditure it has involved.

The British 132-Kilovolt Grid.

Extracts from a paper read before the International Conference on Large Electric Systems held in Paris in June, 1929.

By J. R. BEARD, M.Sc., M.I.E.E.

(*Concluded from page* 585.)

Sub-station Connections and Number of Transformers.—As switchgear forms such a large part of the capital expenditure on the grid, much consideration has been given to reducing it to a minimum. Many of the tapping points will consist of a simple loop-in of a single line, and conditions favour the use of a three-circuit breaker arrangement. The by-pass connection is normally kept open, and one transformer switch and the section switch must open automatically in the event of a fault occurring in either a line or a transformer. This arrangement utilises the minimum of apparatus consistent with rapid resumption of service after a fault, and has been chosen because of the saving in cost, the reduction of maintenance charges, and the decreased number of danger points brought about by the simplification. The by-pass connection is intended for use only if one transformer is out of commission, and provision has to be made for feeding the remaining transformer from either feeder.

A duplicate supply can be given either by two transformers, each large enough to deal with the whole load, or by three transformers, each large enough to deal with half of the load. The accompanying table based on actual contract prices shows the relative costs of various alternative arrangements.

CAPITAL COST OF 132 KV. TRANSFORMING STATIONS.

Including Allowance for Capitalised Transformer Losses and for Two Incoming 132 kV. Feeders and the necessary Lower Voltage Switchgear.

Type of station.	132 kV circuit breakers	Transforming station to give duplicate supply of					
		60,000 kVA		30,000 kVA		15,000 kVA	
		Transformers installed kVA	Cost £	Transformers installed kVA	Cost £	Transformers installed kVA	Cost £
L.N.E. (low non-extensible)	3	2 × 60,000	70,600	2 × 30,000	52,000	2 × 15,000	45,200
L.E. (low extensible)	3	2 × 60,000	73,300	2 × 30,000	54,700	2 × 15,000	47,900
L.D.B. (low double busbar)	5	2 × 60,000	81,800	2 × 30,000	63,100	2 × 15,000	56,300
" " ...	6	3 × 30,000	92,000	3 × 15,000	73,200	3 × 15,000	66,500
" " ...	6	3 × 30,000	89,900*	3 × 15,000	71,500*	3 × 15,000	65,500*

* Allowing for reduction in iron losses by keeping third transformer in commission for only one-third of time.

The minimum spacing between conductors of different phases is 9 ft., and that between any live metal, other than arcing horns and rings and earthed metal, is 4 ft. 6 in.

The main circuit-breakers are built up of single-phase units. Their rated rupturing capacity is 1½ million kVA. The tanks are mild-steel cylinders with cast-steel covers of the same strength as the tanks. Each tank is fitted with valves and screwed caps for coupling it to the oil filtering and storage plant. Circuit-breakers of both the explosion-pot and multiple-break types are being used. The circuit-breakers are normally operated from a 110-volt storage battery; they can be controlled either locally or from a remote point, but not from both points simultaneously. Hand operation can be resorted to in the event of failure of the electrical gear. The normally operated isolating switches are of the rotating centre pillar type. The isolating switches are interlocked with the main circuit-breakers, so that it is possible to make or break current on an isolating switch.

On double-busbar equipments the switches are interlocked, so that it is impossible to make a connection to both busbars at the same time. Further interlocks are provided to prevent a transmission line earthing-switch being opened or closed until the isolating switch on the line is open, or a by-pass switch being opened or closed unless the parallel circuit is complete.

The current transformers are of the single-turn bushing type fitted over the insulators of the primary conductors. The standard full-load secondary current is 0.5 A. Potential transformers are connected to the lower voltage side of the main transformers. The equivalent transformation ratio is 132,000/110 kV, and the secondary winding is tapped to correspond to the tappings on the main transformers. Potential transformers are also compensated to allow for the voltage drop in the main transformers, so that their secondary voltage is a true measure of the line voltage.

All transformers are designed for outdoor working and for transport by road or by rail over all the main British railways. The transport problem is a difficult one, as the British loading gauge is very much more restricted than Continental and American gauges. Special trucks are being constructed by the railways for dealing with the largest sizes. The transformers are slung from narrow, deep, removable side girders, so that the maximum width is available and the transformers can extend to within a few inches of rail level. Wherever possible siding connections are arranged to the transforming stations, but where this is impossible delivery is made by road, although this is more expensive. It has been found possible to meet the limiting conditions with three-phase transformers up to 75,000 kVA.

Up to half output, or slightly more, the transformers operate as naturally cooled units, but above this load forced cooling is brought automatically into operation. This forced cooling consists of an air blast which is normally combined with forced oil circulation through separate oil coolers, but in some instances the air blast is applied directly to radiators on the transformer tanks. Normally, the forced cooling is not in operation, as, with two transformers in commission, of which one can deal with the whole load, each transformer is normally only half loaded, even at peak load. Air-blast cooling has the advantage that no water supply is required, and risks due to corrosion and leakage are reduced.

For transformers of 10,000 kVA rating and less the usual arrangement is to instal standard transformers of double the capacity required, but without the cooling plant. All transformers are equipped with voltage-regulating gear for altering the ratio from 10 per cent. below normal to 10 per cent. above normal in steps of 1.43 per cent. As a rule this is being carried out by on-load tap changing on the 132-kV windings. This regulation is required partly for dealing with voltage regulation on the 132-kV system, and partly to correct for voltage drop in the transformer itself and to give the necessary variation in the local supply voltage.

The 132-kV windings are star-connected, and the neutral point is connected permanently and directly to the transformer tank and earth. This simplifies the voltage-regulating equipment and enables the size of the transformer to be appreciably reduced, thereby facilitating transport arrangements. It also effects an appreciable saving in cost, amounting to at least £500,000 for the whole grid.

Experience with multiple earthing on lower voltage systems has shown that directly earthing the neutral results in more rapid and certain disconnection of faults, and that it is preferable to an insulated-neutral system, even as regards minimum interference with communication circuits.

Two temperature indicators are fitted to each transformer which register the temperature of the oil near the top of the transformer and the highest temperature within the transformer windings. An alarm device gives warning in the event of the winding temperature reaching a predetermined value, and can be arranged to close the tripping circuits of the circuit-breakers controlling the transformers.

Except at three-shift power stations, where permanent earthing facilities exist, a separate earthing transformer is provided for the lower voltage side of each 132-kV transformer. This transformer has a main interconnected-star winding, which is directly connected to the lower voltage side of the power transformer, and an auxiliary star-connected winding to give 400 volts three-phase and 230 volts single-phase.

The earthing transformer can carry the full auxiliary load continuously, and any earth fault current for 15 sec. Where earthing transformers are not required, small unit transformers are provided for auxiliary supplies.

Lower Voltage Systems.—The lay-out is determined on similar principles to that of the 132-kV system, although they partake more of the nature of transmission and distribution networks, and less of the nature of load transfer and equalising busbars. In general they consist of overhead lines operated at 33-kV. A trial is being made on certain lines of reinforced-concrete poles of the hollow spun type. The majority of the lines have steel-core aluminium conductors on narrow-base steel masts and suspension insulators of the three-unit cap and pin type.

In the central parts of London, due to the concentration of generating plant, the load transfers are equally as large and important as those dealt with by the 132-kV system; an extensive 66-kV cable system is being installed, comprising some 100 three-phase circuit miles. Single-core cables are used throughout. These have waterproofing coatings over the lead, and are generally laid direct in the ground with a heavy reinforced-concrete protecting cover some 3 in. above the cables. The three cables forming each three-phase circuit are bound closely together in triangular formation, and the lead sheaths are cross bonded at each set of joints. The phases are transposed at each joint, a complete rotation being effected over each three drum lengths. Part of the cables are of the oil-filled type with 0.355 in. dielectric thickness and a double lead sheath with copper tape armouring between the sheaths. The greater portion, however, is of the more usual construction with 0.65 in. dielectric thickness and a single lead sheath under which is a wrapping of metalised paper. There are to be sixteen transforming stations stepping down from 66-kV to lower voltages (mostly 6.6-kV) or vice versa, but extensive use is being made of transformer-feeder units, in which a transformer is directly and permanently connected to its associated feeder without the intervention of switchgear. In consequence, 66-kV switching has been restricted to seven centres where the busbars and isolating switches are in buildings, but the circuit-breakers are out of doors. The circuit-breakers have the same rupturing capacity as those on the 132-kV system, *i.e.*, 1,500,000 kVA.

The installed capacity of 66-kV transformers will be some 950,000 kVA in three-phase units varying in size up to 45,000 kVA. The general arrangements of connections for cooling and on-load tap changing follow closely those described for the 132-kV transformers, except that the 66-kV system is intended to operate with the neutral point earthed through resistances; the insulation of the 66-kV windings at the neutral point is, therefore, made capable of withstanding the full phase voltage of 38 kV. The range of voltage regulation is plus and minus 7½ per cent.

Line Protection.—Delay in isolating a fault of two seconds will almost inevitably result in the falling out of step of synchronous load. The vast majority of faults on the 132-kV lines will undoubtedly be insulator flashovers, the major portion of which will cause no permanent damage if the flashover is not prolonged. Quick switching will therefore result in the majority of interruptions being of only a temporary nature, but delayed switching will result in long time shut-downs, pending replacement of insulators.

Two conclusions were arrived at:—

(1) That a balanced protective system of the Merz-Price type employing pilots offered the soundest solution, but that the cost of providing separate pilots would be very large if it were generally applied;

(2) That the only non-pilot scheme which could be considered as a practicable alternative was some form of impedance protection, and that for this to be satisfactory the definite isolation of a faulty section should be secured in a maximum period of one second.

Further investigation and development of impedance schemes resulted in considerable advances, and it is believed that satisfactory arrangements have been developed which will give discrimination and isolation, within the time limit specified, in all conditions, except possibly where simultaneous faults develop or where the length of 132-kV line is less than 10-12 miles.

Accordingly pilot protection has been adopted for line sections of 12 miles or less, and impedance-type protection elsewhere. The latter is also used throughout the 66-kV cable system in the London area.

Where lines are directly connected to transformers, separate transformer protection and separate feeder protection are provided. The line protection is of the pilot type and an additional pair of tripping wires is included in the pilot cable to couple up the feeder and transformer protective relays. The line protective gear is designed for a minimum fault setting of 400 A and a maximum section length of 50 miles, and to be stable with through currents up to 7,000 A.

Two forms of pilot-wire protection have so far been adopted: "split pilot" and "translay." Three major difficulties affect the design of pilot protective gear:—

(*a*) Balance of current transformers;
(*b*) Pilot capacity;
(*c*) Surges and resonant transients.

The forms of protection adopted have interesting features in this connection.

With "split-pilot" protection, air-gap transformers having a straight-line ratio characteristic are employed to ensure satisfactory balancing of current transformers. The "split" return ensures that pilot capacity currents oppose and cancel in the split pilot transformer.

High-frequency effects are provided against by tuning the relay circuit to 50 cycles in such manner that the operating current increases very rapidly for frequencies which differ materially from the fundamental. The relay circuit is electrically independent of the pilots.

With "translay" protection, an induction wattmeter type relay is employed, the main windings of which are directly connected to the protective current transformers of the standard closed-core type. A secondary winding is wound on the centre line of the relay iron circuit, which draws its energy by transformer action from the first winding. This secondary winding is connected to the pilot cores through the second winding of the relay.

The pilot voltage and current can be made very small, thus limiting capacity effects. Since any capacity current flow will lead the primary current by a large angle, the torque produced in the wattmeter relay will be small.

To compensate for unbalance of the current transformers a small additional winding is added on the outer link of the

relay iron circuit, which is short circuited through an adjustable resistance. The current induced in this circuit acts as a bias, increasing the setting of the relays in proportion to the magnitude of the fault current.

High-frequency compensation takes the form of a tuned shunt or similar device.

Two forms of impedance protection have so far been adopted: "ratio-balance" type* and "definite impedance" type.

The chief feature in which "ratio-balance" impedance protection departs from the usual form is that the action of the relay is made dependent on the reactance of the line, *i.e.*, on the factor V sin ϕ/I and not on the impedance.

Certain experiments in recent years have suggested that power arcs may possess considerable resistance. Whilst there is considerable doubt on this point, such an effect would tend to produce faulty discrimination, and the object in adopting a reactance base is to eliminate the effect of resistance.

The ratio-balance relay comprises a time discriminating element in the form of a wattmeter movement designed to respond instantaneously when the measured reactance value corresponds to less than 75 per cent. of the protected line section. For faults outside the 75 per cent. zone, including those on adjacent sections, a clockwork mechanism gradually increases the operational ratio of the time discriminating element by means of a variable rheostat and thus causes the relay to operate in a time dependent on the distance of the fault from the relay. This feature provides "back up" protection for adjacent sections.

A definite impedance relay functions instantaneously if the fault impedance value corresponds to less than 90 per cent. of the section of line protected and functions with an inverse time characteristic if the fault lies outside this zone.

Directional elements are employed in both schemes and the voltage supply required for phase-fault protection is obtained from potential transformer connected to the lower voltage windings of the main transformer. The ratio of this transformer is automatically adjusted to correspond to the particular ratio in use on the main transformer and, in addition, a compensating device is included to cover load drop in the transformer.

Transformer Protection.—The combination of bushing type current transformers and a tapping range of 20 per cent. on the main transformers makes it difficult satisfactorily to apply circulating-current protection to the power transformers, unless current transformers can be accommodated in the main transformers, which is difficult of general application.

Accordingly the protective scheme decided upon provides overload protection having an inverse time feature and an adjustable definite minimum setting, together with restricted earth leakage protection for each winding of the transformer. Where the winding is earthed, the leakage protection is restricted to the winding itself by leading the resultant secondary current from the three overload current transformers through the secondary of a current transformer mounted in the earth connection. The overload feature is given a minimum setting of two seconds to secure discrimination with the line protective gear.

Metering System.—The Board's metering system must be capable of measuring over half-hourly periods kWh, kW maximum demand, and reactive kVA maximum demand. From the kW and reactive kVA maximum demand measurements, the power factor at the time of maximum demand will be computed.

In cases in which a supply authority is the owner of a selected generating station the metering arrangements are more complicated because the supply authority has the option of purchasing such of his requirements as are generated in the station at the actual cost of generation, adjusted according to the load factor and power factor of the supply authority's own load.

The Board's metering system for a supply authority owning a selected station must measure separately the following quantities:—

(*a*) The kWh, kW maximum demand, and reactive kVA maximum demand of supplies taken by the supply authority from the Board's transmission system.

(*b*) The kWh, kW maximum demand, and reactive kVA maximum demand of supplies taken from the generating station by the Board's transmission system.

(*c*) The kWh, kW maximum demand, and reactive kVA maximum demand of the generating plant in the station (after deducting the energy used by the station auxiliaries).

The quantities measured under (*a*) represent that portion of the supply authority's consumption which is definitely chargeable at the Board's tariff. The total consumption of the supply authority (*i.e.*, the output to its feeders) is obtained by respectively adding to, or subtracting from, the output of the generators (less auxiliary services), the import from (*a*), or the output to (*b*), the Board's transmission system. The difference between the total consumption of the supply authority and that portion of its supply measured under (*a*) represents that portion which it has the option of paying for at adjusted station costs. The quantities measured under (*c*) enable the generating costs of the station to be computed.

The readings from individual kW and reactive kVA maximum demand meters are added or subtracted by automatic means, in order that each summated reading may correctly represent the simultaneous readings of individual measuring instruments.

For this purpose kWh meters and reactive kVAh meters in the circuits to be measured are so equipped that the sum of readings of two or more instruments is obtained on a separate summator equipment. The kW and reactive kVA demands are obtained from these summators.

Three separate summators are required, both for kW and reactive kVA demand measurements. The first summates the import on the circuits connecting the supply authority to the Board's transmission system. The second summates the readings of integrating instruments on the generator circuits. The third set of summators adds to, or subtracts from, the summated generator output the import to, or export from, the Board's transmission system, and thus enables the total requirements of the supply authority in kW and reactive kVA demand to be computed.

It is necessary to know at what time the maximum loads occur, because the power factor can only be obtained by computation from the reactive kVA demand at the time of the maximum kW demand. Therefore, chart recording or printing devices are fitted to each summator to give a record of the units summated during each half-hourly period.

Each summator is provided with its own timing device for resetting the gear at half-hourly intervals and a master clock is provided at each station to ensure that the resetting occurs simultaneously on all the summators in the station.

All integrating instruments will be duplicated, and, in addition, provision is made for periodic checking of integrating meters by means of portable standards. The accuracy of the summators can be checked at any time by comparing their kWh readings with those of the integrating meters which operate them, and the summators are therefore not duplicated.

Control.—The grid system is divided into eight or nine areas, each under the control of an "Area Control Engineer," who is responsible for the plant in operation at each selected station in his area and for the general connections of the system under his control. To indicate the conditions obtaining at each transforming station and selected power station, a supervisory indication scheme is used employing telephone pairs, hired from the General Post Office and forming part of the public telephone system. A single telephone pair connects each transforming station to a control room situated centrally in each area and the following communications are transmitted automatically to the control room:—

(1) Indication of the position of each 132-kV circuit breaker.
(2) The voltage of the 132-kV busbars at each transforming station.
(3) The transformation ratio in use at each station.
(4) The power flowing through the transformers at each station.
(5) The reactive kVA flowing through the transformers at each station.

The control engineer is also able to transmit a general signal to all stations to "stand by." Each generating station is also in direct telephone communication wth the control room through the same pair of wires as is employed for supervisory indication.

In the control room is a system diagram, adjustable by hand, to suit varying arrangements and showing the complete connections of the system in the area.

* Elec. Rev., August 30th, 1929, p. 375.

Legal.

Edison Accumulators, Ltd., v. New Distributors of Edison Storage Batteries, Ltd.

In the Vacation Court, on October 2nd, Mr. Justice Macnaghten heard a motion by Edison Accumulators, Ltd., for a writ of sequestration of the property of New Distributors of Edison Storage Batteries, Ltd., for an alleged breach of an order made by Mr. Justice Clauson last July restraining the defendants from carrying on business in the name of Edison Storage Batteries, Ltd., or any name so resembling that of the plaintiffs as to cause confusion between the two companies.

Mr. Croom Johnson, K.C., for the plaintiffs, stated that in compliance with the order the defendants changed their name to "New Distributors of Edison Storage Batteries, Ltd.," but it was now complained that in breach of the injunction they had advertised their goods at the Shipping, Engineering and Machinery Exhibition, Olympia, under the name "Edison Storage Batteries" without the word "Ltd.," but with the addition of their address.

Mr. Bray, for the defendants, said that what happened was done without their knowledge or approval. The exhibition authorities, in accordance with the usual custom, asked for their name and address to put over their stall, but were told that this could not be done as litigation was then pending over the name. Mr. Perrin, the exhibition manager, said that in that case they would put up words on a board at the back of the stand indicating the goods to be sold, "Edison Storage Batteries," and without defendants' knowledge added their address.

Mr. Croom Johnson stated that after the motion was launched the address of the defendants was removed from the advertisement, and the exhibition having now come to an end, he did not ask for sequestration, but did ask for costs.

Mr. Bray contended that the plaintiffs were not entitled to costs, as there had been no wilful disobedience of the order.

The defendants did not put up the advertisement, and had no control over the exhibition authorities.

Mr. Justice Macnaghten said that in his view there had been a clear breach of the injunction, but as the address had been removed and the exhibition had come to an end, he would make no order on the motion except that the defendants pay the costs.

Leave to appeal was given.

Case Against the S.W. & S. Power Co. Dismissed.

At the Oldbury Police Court, on October 1st, the Shropshire, Worcestershire and Staffordshire Electric Power Company was summoned by the Director of Public Prosecutions for an alleged breach of Regulation 18 (*d*) under the Factories Act, relating to electrical sub-stations. The case arose out of a fatal accident in the McKean Road sub-station, Oldbury, on July 4th. A fully-competent electrician with his mate was instructed to remove from a block of steel-clad switchgear a spare cubicle containing the incoming switchgear operating at 5,500 V. Before commencing the work the electrician tripped the oil switch and drew the isolating links, thus making "dead" the middle and upper sections of the incoming cubicle, and also the whole of the spare cubicle. The incoming cable remained "alive," but the bottom section, enclosing the terminals of this cable was made safe by a screwed-on steel cover. After the spare cubicle had been unbolted, the electrician unscrewed the back plate of the middle section of the incoming cubicle, and also took off the protective plate of the bottom section of that cubicle for inspection. He then noticed a lamp wire in the middle section of the cubicle which connected with the detached spare cubicle, and, omitting to replace the plate on the bottom section containing the terminals of the incoming cables, proceeded to remove the lamp wire from the middle section. In so doing his knee came into contact with the terminals and he was killed.

The case for the prosecution was that no work should have been done on the switchboard without first making "dead" the whole of it, including the incoming cables, and that there was no independent provision for making "dead" those cables except by disconnecting the whole of the cable at the Oldbury Road sub-station some distance away, thus disconnecting also a number of consumers *en route*.

The company contended that the case fell within Regulation 18 (*d*) (ii), and that as the switchboard was built in sections and each section could be made "dead" independently, and as it was not necessary actually to do any work in the "live" section, there had been no breach of the Regulations.

The magistrates agreed that the switchboard was built in sections and came within Regulation 18 (*d*) (ii), and that no work had to be done in the "live" section. The case was accordingly dismissed.

Summons Against Chesterfield Corporation Dismissed.

The *Yorkshire Post* reports that the Chesterfield Corporation was summoned at the local Police Court on October 3rd for failing to make dead a switchboard during the removal of temporary hoisting equipment, and for working conductors dangerously and not having them protected.

Mr. G. J. Ball, for the Director of Public Prosecution, said that a workman named Shelley was removing a scaffold pole when his foot slipped on the unlashed end of the pole, causing him to fall 10 ft. on to a live bar charged at 33,000 volts. It was submitted that before the man was allowed to tackle the job the whole of the switchboard and conductors should have been made dead.

Mr. J. F. Peaker, deputy electricity manager, said that he and Shelley made dead all apparatus but a bar behind the switchboard. Witness reminded Shelley that the bar was alive, and the man answered, "All right." Mr. N. Winning (for the Corporation) said it was never intended that Shelley should be nearer than 4 ft. 6 in. to the live bar, and had he not put his foot on the loose pole it would have been impossible for him to touch the bar. He submitted that there was no negligence.

The magistrates dismissed the three summonses; and when Mr. Ball asked for a case to be stated, the chairman (Mr. D. N. Turner) declined, stating that the case rested purely on a question of fact.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

A New One-piece Industrial Reflector.

A new improved type of "Philips NR" industrial reflector (fig. 1) has recently been introduced by Philips Lamps, Ltd., Philips House, 145, Charing Cross Road, W.C.2. The outstanding feature of this apparatus is that it is stamped from one piece of heavy-gauge metal, with an entire absence of welded or other joints. The angle of the cut-off is in accordance with

Fig. 1.—New "Philips NR" Industrial Reflector.

Home Office recommendations. The fittings are made in five sizes, ranging from 10 in. to 18 in. in diameter, and can be supplied with hook suspensions or screwed bushes (⅜ in. and ¾ in. conduit thread or ½ in. gas). The 10 in., 12 in., and 14 in. sizes can, in addition, be supplied with 1¼ in. holes. The reflectors are manufactured from vitreous-enamelled heavy-sheet steel, white inside and black outside, and the workmanship is of the highest standard throughout.

A Bakelite Pocket Lamp.

We have received from the Runbaken Magneto Co., Tipping Street, Ardwick, Manchester, a sample of the "Everbrite" pocket lamp which it has recently produced, and for which the General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, is the sole selling agent for the electrical trade. The pocket lamp is of robust construction, and all parts are interchangeable. It has a moulded bakelite case of handsome appearance, in black or brown finish. It is equipped with a 5-plate unspillable battery, which will give 9 to 10 hours' continuous light. The metal parts are lead-plated to prevent corrosion. A chart for registering the date of the last charge is contained on the inside of the cover. The standard model is fitted with a charging device, which enables the battery to be charged without removing it from the case. The outfit includes a spare bulb and clip. The weight complete is 8½ oz. The pocket lamp is guaranteed for five years. A focussing attachment can be supplied for an extra charge.

Home Office Pattern Propeller Fans.

The knowledge that the present neglect of the Home Office Regulations, regarding the type of extractor fans that are used for the removal of fumes of a highly inflammable and explosive nature will not be permitted in the future, has prompted Messrs. S. G. Leach & Co., Ltd., (associated with Messrs. M. W. Woods, Ltd.), 26-30, Artillery Lane, E.1, closely to examine the difficulties that had to be overcome to satisfy the Home Office requirements. It was immediately apparent that the motor driving the fan impeller should be of a flame-proof design, and a close study of the Home Office requirements has resulted in the "Leach-Woods" Home Office pattern propeller fan (fig. 2). The motor, for use on both a.c. and d.c., is a totally enclosed, continuously rated motor, complying with the B.E.S.A. Specification. The end covers of the motor are of special design, so arranged that in the event of an explosion occurring, by the time the ignited gas has reached the outside atmosphere, owing to the large machined surfaces of the covers, the temperature would be sufficiently reduced to prevent any fear of further ignition. The terminal box, which is cast in an integral part of the back end cover, is designed on the same principle, and fitted with a heavy machined lid securely fixed by four hexagonal screws.

A point that has also received careful attention is the design of the impeller or blade end bearing. In addition to the ordinary ball bearing, which is fitted to take radial and end

thrust, a special grease stuffing gland has been introduced to prevent the possibility of any inward leakage of the outside atmosphere. The 4-way heavy duty "Leach-Woods" propeller blade, is, owing to its special design, eminently more suitable for use on air extraction, this being due, not only to the much larger volume of air that it will move, and hence higher velocity, an important point where the fan is dealing with fumes having a very much greater density than normal air has, but also to the fact that it is capable of satisfactorily working against the relatively high resistance which may be set up by duct work.

The range of sizes for these fans has been limited to 12, 15, 18, 24, and 30 in., but the designs for larger fans up to and

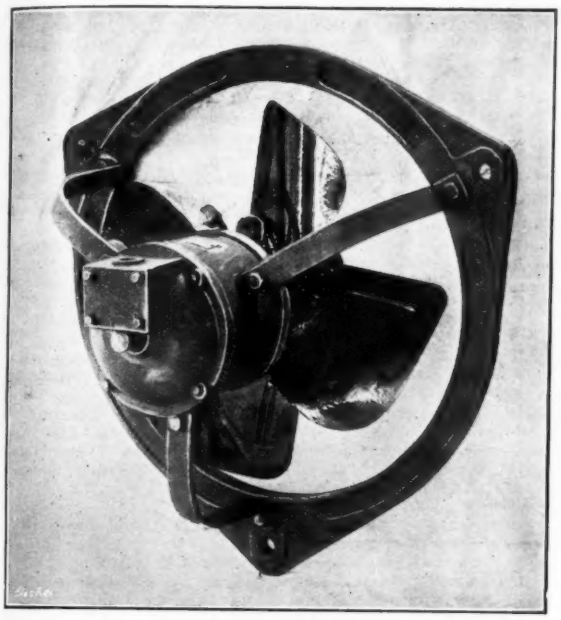

Fig. 2.—"Leach-Woods" H.O. Propeller Fan.

including 60 in. size, these latter in particular for working against resistances up to about 1½ in. water gauge, are being proceeded with. The fans are British made throughout at the Colchester Works.

A New Insulating Material.

"Mycalex," a new electrical insulating medium, is claimed to represent what is probably the most revolutionary advance in applied electro-chemistry since the introduction of synthetic resins. It is a vitreous product composed of pure electrical mica (or other base), intimately associated with a vitreous flux resulting essentially in a new medium (not merely a new material), which is perfectly stable and inert under all conditions likely to be met with in service. It can be produced in sheets, rods, or tubes. It can be extruded into any section, and moulded in conjunction with metal inserts. The finished product, although of the consistency of porcelain, can be drilled, tapped, sawn, or machined in the lathe, and its mechanical strength surpasses that of any other insulating material. "Mycalex" is essentially a British product, but hitherto it has been manufactured in America and Germany under licence from the patentees. Now, however, it is to be produced in England, under the personal supervision of the inventor, Mr. P. B. Crossley, F.I.C., M.I.Chem.E., who has designed the special plant for that purpose. The works are at Harlesden, near Willesden, Middlesex, and the registered offices of the Mycalex (Parent) Co., Ltd., are at Abbey House, Westminster, where specimens can be seen by those interested. Noteworthy amongst these specimens is the model high-tension stator-bar with the insulation moulded on, in intimate contact with the metal, leaving no air-spaces. The new material can also be made in different grades to suit requirements, ranging from the ordinary grade, which is refractory at 450° C., up to a special arc-resisting quality of an alternative base composition. It can be produced in a variety of colours and with glazed surfaces. The dielectric losses compare favourably with high-grade ebonite, so that insulating medium has an enormous field of application in high-frequency work, either for panels (where its high mechanical strength enables the thickness to be appreciably reduced) or for strain insulators, where the material is either in tension or compression.

An Automatic Scaling Machine for Electric Welding.

In our issue of September 6th, under the above heading, we described an automatic scaling machine introduced by the Westminster Engineering Co., Ltd., Victoria Road, Willesden Junction, N.W.10. It should have been mentioned that the machine is patented in this country, and that applications have been made for foreign patents.

A Smoke Abatement Conference.

Report of the Proceedings at Buxton.

THIS year's smoke abatement conference, which was held at Buxton (October 4th to 6th) was of peculiar interest, for it marked the merging of the Smoke Abatement League of Great Britain and the Coal Smoke Abatement Society into a new association for which the title of the National Smoke Abatement Society was unanimously chosen. The proceedings at Buxton, whilst being to a large extent concerned with the domestic arrangements of the new Society, of which Dr. H. A. Des Voeux was chosen president, were also marked by the delivery of two very interesting papers, one dealing with the industrial uses of gas and one with the industrial uses of electricity. The gas address was prepared by Mr. S. Tagg, manager of the Preston Gas Co.; whilst interesting, and in certain respects convincing, it was not such a complete summary of the position as was that given on behalf of the electrical industry by Mr. Verdon Cutts, of the General Electric Co., Ltd., who very wisely devoted his attention to the particular subject in which he is expert, *viz.*, the application of electric heat to industry. He said that thus far its development and application had been the work of the pioneer and the enthusiast, and consequently the details and incidents of such development had not been so generally known as would probably have been the case if more people had been engaged on the work. Industrial heating by electricity had definitely arrived, and no power on earth could arrest its progress. To the central station engineer it was of vital importance, because it represented a load-building factor of considerable magnitude. It was of equally vital importance to the electrical manufacturer, since that which created a demand for electrical energy must also call for plant and equipment. To-day's tendency towards improved methods and equipment to ensure better production at competitive manufacturing costs had created a demand for the precision and efficiency which electric heating rendered possible. A degree of exactitude which had hitherto been regarded as commercially impossible was now attainable on a production basis under ordinary shop conditions, thus facilitating scientific management. Mr. Cutts then went on to say that in many cases and for many purposes the electric furnace, or oven, was capable of competing with fuel-fired furnaces on a straight cost basis. Even where that was not possible there was a considerable field in which the value of the inherent advantages of electric heating fully justified its use. Whilst recognising those favourable facts, it could not be denied that there were other purposes and circumstances for which and in which electric heating could not at present compete with fuel-fired furnaces and ovens. In fact, he would go further and state that those who were genuinely interested in the development of industrial electric heating should definitely discourage any projected application which was not certain of success from an economic point of view, even though technically it might be quite feasible and practicable. Mr. Cutts described in general terms and in a most convincing manner the wide range of application and the inherent characteristics of electric heat, affirming that the electric furnace and oven represented an important contribution to the subject of smoke abatement. He devoted the closing portion of his discourse to a brief reference to a few specific applications of electric heat to industrial processes. He turned to the steel industry, and to the audience this was particularly interesting, for the previous speaker had, presumably by mere coincidence, devoted a section of his address to the subject of gas heating in the steel industry. The first application of electric heating to that industry, said Mr. Cutts, was for melting and steel making. Now the use of electric melting furnaces in the steel industry was confined almost exclusively to the melting of scrap, the refining of Bessemer, or open hearth, steel, and to the production of special alloy steels. Regarding the matter primarily from the smoke abatement point of view, the most important field for the electric furnace in that industry was that of heat treatment. Probably no branch of metallurgy had advanced so rapidly as the heat treatment of steel. The electric furnace was asserting itself forthat work, because it was vital that the temperatures to which steel was heated should be determined with the greatest possible precision consistent with works practice and shop conditions. Especially was that true of alloy steels, to illustrate which he referred to an incident within his experience. A firm having a large and important trade in carbon steels with the United States found it necessary to hold heavy stocks of certain sizes ready for immediate dispatch. When the Fordney tariff came into force those stocks were thrown on to their hands. A market was ultimately found for that steel and the first 20 tons delivered, but it failed miserably, with consequent disappointment to all concerned. Some few months later a further batch of the same steel was heat treated in an electric furnace and sent to the same works which had rejected the first lot. The report was that it was a different steel altogether and that it suited their purpose admirably. The difference was that the first lot had been indifferently heat-treated in a fuel-fired furnace, which was incapable of the necessary uniform and precise temperature control, whilst the second batch had been heat-treated

with precision and the desired physical properties been developed and fixed.

In annealing, hardening, tempering, normalising, case-hardening, and the general heat treatment of steels there was a definite field for the electric furnace. In recent years there had also been marked development in special steels, such as those of the stainless variety, which at various stages required heating under conditions which precluded the possibility of their being licked by flame or coming into contact with any products of combustion.

In the non-ferrous trades the electric furnace was being used for the melting of brass, copper, zinc, aluminium, gold, silver, &c., with conspicuous results. The considerable reduction in melting losses which the electric furnace rendered possible not only made for economy, but also enabled alloys of precise analysis to be produced with ease. In the annealing and normalising of those metals and alloys similar considerations apply to those already referred to. In some cases the temperature margin was so very slight as to call for electric heating even when the cost of the electrical energy exceeded that of other fuel. For the refining of aluminium the electric furnace was ideal from a metallurgical point of view, working with a perfectly quiescent bath in an atmosphere free from gases.

Electric core-drying stoves were growing in number, although at the present time they are being chiefly used for small cores. Another interesting application of growing importance was the vitreous enamelling of metals. With the advent of the electric furnace that ancient art had developed into a modern industry of no mean size. The upkeep cost of an electric enamelling furnace was low and a very important point was cleanliness; the sulphur fumes and other products of combustion in fuel-fired furnaces caused contamination which was definitely detrimental. The reason why electric furnaces were being adopted more generally for such work was because many manufacturers had found that they got a better product under better working conditions; also a reliable rate of manufacture, free from interruptions. It was a significant fact that in a large number of cases in which electric furnaces were being used for that purpose, the cost of energy consumption was actually greater than the corresponding cost of fuel, but the incidental and consequential savings were so considerable as greatly to outweigh that initial disadvantage.

The baking of japan, paint, varnish, lacquer, &c., was a purpose for which the electrically-heated oven was ideally suited. As a rule it gave an excellent finish, was clean and safe, and lent itself admirably to automatic control.

For sherardising, electric furnaces with automatic control were suitable and there were now several electric galvanising installations in successful operation, in which electricity was used for heating the zinc tanks. The annealing of glass was a duty which called for just those features which were characteristic of the electric furnace. Accurate adjustment of temperature and even application of heat were prime essentials in that work. Shallow temperature gradients were required. The ease with which electric heat could be controlled automatically was a great advantage, as it eliminated, or minimised, labour requirements in a process which extended over long periods of time. The electric furnace was also a clean proposition, as the ware did not absorb products of combustion and was free from sulphurage. Rejects due to breakage or distortion were practically eliminated. Electric furnaces were being applied to many other specialised trades, including ceramic work, china firing, decorating high-grade china, the firing of stained glass, &c., as well as for assay, test, and other purposes.

At a general meeting of members of the new National Smoke Abatement Society held on October 6th the new constitution was fully considered. The objects of the Society are clearly defined as (1) to create an informed public opinion on the evils of air pollution; (2) to inquire into, and, if thought advisable assist, investigations directed towards the abolition of smoke, whether industrial or domestic; (3) to take steps to popularise the use of smokeless methods of heat and power production; and (4) to promote and support legislation for preventing the pollution of the atmosphere.

It would appear that the work of the Society is deserving of greater support on the part of the electrical industry than it has in the past received.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

Unappreciated Economies of High Voltages.

Certain comments which I have received relating to the article of mine which appeared in your issue of September 13th would make it appear that I did not sufficiently emphasise that the deductions in that article applied with even greater force if the change in voltage were from 5,500 volts to 22,000 volts than if the change were made from 33,000 volts to 132,000 volts.

Any lack of emphasis which my article possessed on this point was perhaps a little further exaggerated by your leaderette, which was labelled "132 kV Cables"—thus giving the impression that *only* 132 kV cables were in question.

Consequently, there is a danger of engineers who still possess 5,000-volt sub-stations not realising that, so far from there being nothing of interest to them in a change of voltage, *they have even more to gain* in changing to, say, 33,000 volts than has a system in which the change is made merely from 33,000 volts to 132,000 volts.

In fact, where equal quantities of power transmitted are at stake, the annual saving by changing over from 5,000 volts to 33,000 volts is of the order of *no less than, say, 5-6 times* that obtained in a change-over from 33,000 volts to 132,000 volts.

Similar (but not equal) benefits would apply to those systems which now employ 11,000 volts at sub-stations, if they raised this to 66,000 volts.

Trusting that this point may not be entirely without interest to many of your readers.

A. M. Taylor,
Major, S.O.2.

Birmingham, *October 3rd*, 1929.

Domestic Wireless.

May I be allowed a little space to reply to Mr. F. Boysen and Mr. G. E. Moore?

Mr. Boysen's "failure to see" may be due to the too frequent use of a.c. for reading illumination, as I have already indicated. If he will try a few simple stroboscopic experiments by a.c., I think he will be convinced.

I do not think I can be accused of prejudice against "eliminators" as such, since the first rectifier shown at the Institution of Electrical Engineers in 1923 was of my manufacture, but I still maintain that claims made for their use are unnecessary and unjustifiable in many cases.

Mr. Moore is even more severe. He accuses me of "antipathies" to a.c., but I must deny such an attitude as both unscientific and unreasonable. If, however, he extends his accusation of antipathy to the use of a.c. for domestic and general purposes he is correct, and I should be a humbug to conceal it.

Alternating current has one outstanding and unassailable property: that of easily transforming pressures for distant energy transmission generally, otherwise it is a crude, makeshift current, justifiable almost entirely by commercial expediency, that is, cheapness.

For traction, small motors, illumination by filament, arc, or vapour (including cinema projection), physiologically, for telegraph or telephone use, for electro-chemical purposes (including deposition and secondary cell charging) a.c. is inferior to continuous current, and peevishness will not alter even "technical facts."

It should be incumbent on suppliers of current to install convertors to continuous current to all communities exceeding 100 consumers.

I should hate to spoil Mr. Moore's Utopian "pictures of the future," but should like to point out that achievement is generally attained by those who look not too far ahead of the present.

As I close the door, dare I ask Mr. Moore his opinion, in the light of "logic and trading," of the interest manifest quite recently in crystal sets?

A. Mortimer Codd.

Esher, *October 5th*, 1929

My Electric House.

I do not wish to prolong unduly the discussion on my recent article under the above heading, but I feel that the remarks of Mr. N. Williams in your issue of September 27th call for comment.

In the first place, I would point out that, realising that reliable information as to operating costs is scarce at present, my article was primarily intended as a description of my own domestic installation and the results obtained, with the hope that others would be encouraged to prepare similar reports, which would be useful for propaganda purposes. Mr. Williams, however, seems to have taken me to task as to whether the average householder can afford to spend £27 a year for current. Although this matter is really outside the scope of my article, the points he has raised are extremely interesting, and if it is not encroaching on your valuable space too much, I shall be pleased to deal with them.

He asks "how many people in this country can afford to pay £20 to £27 per year for current?" I submit that his contention that "only the highly paid people or those with some means" can afford this is entirely erroneous. £27 a year is 10/- a week, and, as you point out in your leaderette on this subject in your current issue, there are not many householders who can limit their total coal, gas, and electric light bills to this figure. It really comes to this: that the householder using electricity for all his services is presented with four comparatively large bills per year, instead of the numerous ones he would receive if he employed gas, coal, and electricity, which, although smaller individually, are in the aggregate quite as large, if not greater. Psychologically, no doubt, the effect on the recipient of the bills is greater in the former case than in the latter. The results published in your current issue concerning the consumptions of the cottages in the L.C.C. housing estate of the Barnes undertaking are

another proof in this matter; also, the average running costs stated are well within the limit of £15 a year of Mr. Williams.

Mr. Williams is of the opinion that my installation must have "cost quite a lot of money." Personally, I do not think that there is anything particularly wonderful about it. Let us examine the list I gave in Table I in my article. Lighting of some form or another has to be provided in all houses, so this can be neglected. I would point out right away that I did not obtain all this equipment at the same time. According to the state of the exchequer, this was added piece by piece over a period of three or four years. The wiring for the power and heating points was carried out by myself, additional points being installed from time to time as required. The cooker and one kettle were obtained on hire from the supply undertaking. The majority of the consumption is accounted for by the cooker, radiators, and water heater. The remainder of the equipment costs very little to run, but adds considerably to the comfort and convenience of the household. If one systematically purchases various domestic appliances from time to time as opportunity presents itself, it is surprising the number of handy little gadgets one finds in one's possession after a few years.

I think that Mr. Williams is more than a little unfair to me when he suggests that I have "given no thought to the poorer classes who require greater assistance to be able to enjoy these things." Personally, I should like to see every home in the land electrically equipped. But, like every other innovation, this is popularised *downwards* through the ranks of society. Gas lighting, for example, at one time was the province only of the very rich, but nowadays it is usually within the reach of the poorest in our towns and cities. Therefore, in my opinion, it is incumbent on gentlemen like Mr. Williams and myself to equip our homes electrically as extensively as possible, in order that the benefits and advantages of "the little world," in which I am accused of living in splendid isolation, may be extended to those less fortunately placed. I would say, in conclusion, that my own experience, in dealing with the requirements of domestic consumers of the undertaking with which I am connected, indicates that this "little world" has already become a fair sized planet and is still rapidly growing.

Reg. H. Rawll.

Birmingham, *October 6th*, 1929.

British Industries Fair, Birmingham.

The Fair authorities are very anxious to introduce into the Fair anything which will tend to promote smooth working and assist visitors.

There appears to be a demand for some method of signalling throughout the Fair to enable, *e.g.*, the chairman, secretary or other, officials to be found and to convey other messages throughout the building. I understand that the number of different messages that it is desired to transmit is between 10 and 20, and the Fair authorities have asked if we can suggest some method of conveying such signals.

I shall be glad to hear from any firms or individuals who would like to suggest methods of dealing with the problem which I have indicated.

W. A. Vignoles,
Director and Secretary,
Electrical Development Association.

London, *October 7th*, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1928.

7,617. "Telegraph systems." A. H. Marks and P. Russell (legal representatives of E. C. R. Marks, deceased) (Western Union Telegraph Co.). March 6th, 1928. (318,841.)

10,084. "Arrangement in asynchronous machines with commutator machines mounted in cascade." Siemens-Schuckertwerke Akt. Ges. April 14th, 1927. (288,630.)

11,199. "Alternating-current commutator motors." British Thomson-Houston Co., Ltd. April 16th, 1927. (288,987.)

13,207. "Electric luminous signs and signalling apparatus and their controllers." J. P. Naylor. May 4th, 1928. (318,903.)

13,508. "Means for varying the temperature coefficients of induction-measuring instruments." Landis & Gyr Soc. Anon. September 9th, 1927. 296,774.)

14,188. "Telegraph systems." W. E. Beatty (Bell Telephone Laboratories, Inc.). May 14th, 1928. (319,032.)

14,276. "Electrolytic condensers." A. E. White (Fansteel Products Co., Inc.). May 15th, 1928. (319,033.)

16,345. "Sparking plugs." Graflich Schaffgotsche'sche Werke Ges. June 4th, 1927. (291,724.)

16,386. "Synchronisation of machines for recording sounds and movements." C. H. Verity. June 5th, 1928. (Cognate applications 21,249/28, 23,251/28, and 30,476/28.) (318,847.)

16,732. "Electrostatic loud-speakers and the like." E. Reisz. June 8th, 1928. (318,876.)

16,741. "Carrier frequency signalling systems." Elect ical Research Products, Inc. June 11th, 1927. (292,077.)

16,812. "Means for tuning radio-sets." H. N. Marvin. June 9th, 1928. (319,037.)

17,100. "Automatic and semi-automatic telephone exchange systems." Standard Telephones & Cables, Ltd. (G. Deakin). June 13th, 1928. (318,944.)

17,101. "Automatic and semi-automatic exchange systems." Standard Telephones & Cables, Ltd. (G. Deakin and L. Polinknowsky). June 13th, 1928. (318,945.)

17,103. "Signalling systems." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). June 13th, 1928. (318,946.)

17,104. "Electric resistance units." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). June 13th, 1928. (318,947.)

17,121. "Electromagnetic devices." A. Wright. June 13th, 1928. (Addition to 291,494.) (318,950.)

17,151. "Synchronising systems for use in television systems." Electrical Research Products, Inc. June 23rd, 1927. (292,597.)

17,157. "Magnet cores." Automatic Telephone Manufacturing Co., Ltd., and P. N. Roseby. June 13th, 1928. (318,953.)

17,174. "Electrolytic cells." Montecatini Soc. Générale per l'Industria Mineraria ed Agricola. June 14th, 1927. (292,130.)

17,231. "Switching mechanism for automatic or semi-automatic telephone systems." Standard Telephones & Cables, Ltd. (L. J. J. Schreiber). June 14th, 1928. (319,046.)

17,357. "Dials or the like for electrical condensers or other electrical instruments." C. F. Burton and H. Burton. June 15th, 1928. (319,051.)

17,438. "Aerial systems." Standard Telephones & Cables, Ltd. (Bell Telephone Laboratories, Inc.). June 15th, 1928. (319,055.)

17,459. "Electrical plug-and-socket connections." J. B. Tucker. June 16th, 1928. (Cognate application 1,507/29.) (319,058.)

17,506. "Iron-cored inductances." Radio Instruments, Ltd., and W. L. Shaw. June 16th, 1928. (319,061.)

17,519. "Maintenance of constant frequency in high-frequency electric circuits." C. Lorenz Akt. Ges. June 24th 1927. (292,600.)

17,710. "Control of electric motor-generator sets." British Thomson-Houston Co., Ltd., and R. D. Parry. June 19th, 1928. (319,072.)

17,715. "Electric terminals." General Electric Co., Ltd., and R. J. Kaula. June 19th, 1928. (319,074.)

18,387. "Amplifiers of sound-reproducing instruments." J. Durham. June 25th, 1928. (319,080.)

18,804. "Sound transmitter." W. L. Walker. June 28th, 1928. (319,084.)

18,876. "Coin-freed mechanism, particularly applicable to prepayment devices for use with electric meters." C. E. Fry. June 29th, 1928. (319,085.)

19,282. "Massaging machine with electromagnetic engines." N. E. Goodrich. July 3rd, 1928. (319,088.)

20,549. "Electric lampholders." R. Nettl. July 16th, 1928. (319,095.)

20,778. "Sparking plugs." Graflich Schaffgotsch'Sche Werke Ges. July 29th, 1927. (Divided application on 291,724.) (Addition to 291,724.) (294,649.)

21,030. "Portable wireless receiving apparatus." P. D. Tyers. July 19th, 1928. (319,100.)

23,531. "Television apparatus." L. Tschorner. August 15th, 1928. (319,115.)

23,540 "Induction motors." Siemens-Schuckertwerke Akt. Ges. November 3rd, 1927. (299,865.)

23,889. "Stringed loud-speaker." C. Midhat. August 20th, 1928. (319,118.)

23,944. "Means for automatically controlling an electromagnetic device." E. Quartier. August 20th, 1928. (319,120.)

24,075. "Electromechanical vibrating devices for use, for example, in loud-speakers." M. Trouton and Wireless Music, Ltd. August 21st, 1928. (319,121.)

24,433. "Newspaper conveyors." Igranic Electric Co., Ltd., A. H. Curtis, A. H. Mackley and H. H. Rapley. August 24th, 1928. (319,123.)

25,863. "Poles, masts, and the like for supporting overhead electric wires and for similar purposes." A. H. Seabrook and A. Avis. September 8th, 1928. (319,133.)

26,735. "Impulse senders of the finger-disc type." Telefonaktiebolaget L.M. Ericsson. September 20th, 1927. (297,388.)

27,198. "Wireless receiving apparatus." A. E. Bowyer-Lowe. September 21st, 1928. (319,141.)

27,938. "Thermionic valves." Marconi's Wireless Telegraph Co., Ltd. September 29th, 1927. (297,847.)

28,411. "System and apparatus for producing or reproducing sound." G. R. H. Caine and H. Scott-Dennington. October 8th, 1927. (298,475.)

28,455. "Method of and apparatus for the electrolytic revivification of ferrocyanide of potassium formed in the purification of gases by oxidation of hydrogen sulphide with ferrocyanide of potassium." R. Brandt. October 4th, 1928. (319,147.)

28,543. "Timepiece with electric driving mechanism." E. Beck. October 5th, 1927. (298,302.)

28,663. "Electromagnetic relays with two armatures." Siemens & Halske Akt. Ges. October 6th, 1927. (298,341.)

28,908. "Protecting device for current-distributing plants." Rheinisch-Westfalisches Elektrizitatswerk Akt. Ges. October 7th, 1927. (298,490.)

31,864. "Apparatus for amplifying and/or rectifying oscillations." Telefunken Ges. fur Drahtlose Telegraphie. November 5th, 1927. (300,124.)

36,724. "Electrical control devices." Associated Electrical Industries, Ltd. December 13th, 927. (302,286.)

36,841. "Construction of transformers, choking-coils, and other parts of wireless apparatus to facilitate assemblage." J. Feldman. December 13th, 1928. (319,167.)

37,247. "Electron-discharge devices." British Thomson-Houston Co., Ltd. December 22nd, 1927. (302,908.)

38,043. "Combined table-lamp and loud-speaker." E. F. Schafer. December 24th, 1928. (319,175.)

1929.

2,924. "Power supply apparatus suitable for use in supplying thermionic valves and the like." Siemens & Halske Akt. Ges. January 27th, 1928. (305,049.)

4,473. "Tramway points." H. Grengel Weichenbau Ges. February 10th, 1928. (305,935.)

7,970. "Automatic and semi-automatic exchange systems." Standard Telephones & Cables, Ltd. (G. Deakin and L. Polinkowsky). June 13th, 1928. (Divided application on 318,945.) (318,956.)

7,971. "Automatic and semi-automatic exchange systems." Standard Telephones & Cables, Ltd. (G. Deakin and L. Polinkowsky). June 13th, 1928. (Divided application on 318,945.) (318,957.)

7,972. "Automatic and semi-automatic exchange systems." Standard Telephones & Cables, Ltd. (G. Deakin and L. Polinkowsky). June 13th, 1928. (Divided application on 318,945.) (319,063.)

9,348. "Control mechanism for centrifugal compressors." British Thomson-Houston Co., Ltd. March 22nd, 1928. (308,369.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from the dates mentioned:—

SEPTEMBER 25th.

Chromalox. No. 505,441. Class 8. Electrical resistances.—Geo. Bray and Co., Ltd, Bagby Works, Leicester Place, Leeds.

OCTOBER 2nd.

Turnlight (lettering and design). No. 493,287. Class 8. Electric batteries (not for medical purposes).—Die Batterien & Elemente Fabrik System Zeiler Gesellschaft, 20, Rungestrasse, Berlin, S.O.16, Germany. (British representatives: Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Jumbo (lettering only). Nos. 502,066 and 502,597 (word and design). Class 8. Wireless telephonic and telegraphic apparatus and parts thereof, &c. —The Parlophone Co., Ltd., 1, Broad Street Place, E.C.2.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERDEEN.—Reconstruction and extension of harbour (£250,000); R. Gordon Nicol, Harbour engineer.

ACCRINGTON.—Housing scheme (114); borough surveyor.

ADDISCOMBE.—Houses (50), Hillcote Avenue and Gibson's Hill; H. Macintosh.

ARBROATH.—Additions, including electric cranes, for James Keith & Blackman Co., Ltd., engineers; Gordon and Scrymgeour, architects, Dundee.

AYR.—Rebuilding of Ayr Playhouse; George Green, picture house proprietors, Glasgow.

BERWICKSHIRE.—Schools, Chirnside and Eyemouth; clerk, Education Authority, Berwick.

BEXHILL.—Houses (40), Sidley estate; Tree & Castle, Ramsgate. Houses, Barnhorn Road, Cooden Drive, and Terminus Avenue; J. E. Maynard.

BILLINGHAM.—Housing scheme (88), for the U.D.C.; surveyor.

BOLTON.—Estate development, off Ellesmere Road; Sir W. B. Hulton. Development, Lord Bradford's estate, off Manchester Road; George Henderson, agent. Senior school (720 places), Whitecroft Road, for the E.C. Additions, Theatre Royal, Churchgate; Bolton Theatre and Entertainments Co., Ltd. Additions, Runworth Cinema, St. Helens Road; Bolton Cinema Co., Ltd.

CHURCH GRESLEY (Swadlincote).—Re-erection of works, for Mansfield Bros.

CRANLEIGH (Surrey).—Public hall (£4,600), with heating and lighting, for the Parish Council; Mr. Wade, architect.

CROYDON.—Houses (500) and shops, Woodvale estate; Central Estates Co., Ltd., Kenton, Harrow. Shops (11) and houses, Zermatt Road; A. Andrews. Two villas for 100 patients at mental hospital; J. M. Sheppard. Elementary school, Lodge Road (£28,620); J. R. Gray, Coventry.

DARWEN.—Baths (£36,000); borough surveyor.

DEAL.—Electric lighting installation, Town Hall, for the T.C.; borough surveyor.

DUMFRIES.—Warehouse, shops and offices, with electrical work; J. & J. Hall, architects, Landhope Vale, Galashiels.

EDINBURGH.—Houses (250), for the Corporation; city architect.

GREENOCK.—Depôt and offices, for Anglo-American Oil Co.; the manager.

GRIMSBY.—Conversion of Manor House, Brighowgate, to hotel; C. W. Dixon, builder.

HASLINGDEN.—Sewage disposal works (£50,000), for Haslingden, Rawtenstall and Bacup Outfall Sewage Board.

HOUNSLOW.—Houses (56), Whitton Park estate; P. Chase Gardener & Co., architects.

HULL.—Laboratories, Alfred Gelder Street, for the city analyst (£8,244); D. Harvey, city architect.

INVERNESS.—Reconstruction and adaption of infirmary as nurses' home; the medical superintendent.

IRISH FREE STATE (Maynooth, Co. Kildare).—New wing, St. Patrick's College; Ashlin & Coleman, architects, 7, Dawson Street, Dublin (returnable deposit of £3 3s.).

(Maryborough, Queen's Co.).—Rewiring mental hospital, for the Committee of Management; Denis Heaney, borough engineer, Thurles, Co. Tipperary (returnable deposit of £5 5s.).

IRLAM.—Housing scheme (50); surveyor to U.D.C.

LEEDS.—Houses (40) and flats (24), Meanwood estate; W. Thompson & Sons. Houses (28) and flats (12), St. Albans estate, houses (60) and flats (24), Southfields estate; Paul Rhodes, Ltd. Clinic, Harehills Lane, for the E.C. Tenders to James Graham, director of education, by October 14th (deposit, £1 1s.).

KIRKINTILLOCH.—R.C. school (£48,000); clerk, Education Authority, Dumbarton.

LONDON (Ilford, E.).—Houses (500) and shops, Aldborough Grange estate; Suburban Developments (London), Ltd. Houses (173), Meadway, &c.; J. Aldridge. Development, Hedgemans Hall estate; Rawlins, Culver & Co. Central school, Bean site, for the E.C. Nurses' home, &c., Isolation Hospital (£11,000); borough engineer. Factories, Grove Road; W. G. Young (3), F. Smith (1), H. Chappel & Co., Ltd. (1).

(Barking, E.).—King George Hospital (£70,000), for the Committee; Roland Hill, chairman. Housing scheme (237) and flats (24), for the U.D.C.; surveyor. Extensions, Hart Lane; Cape Asbestos Co., Ltd. Extensions, West Bank; Russian Oil Products, Ltd.

(Beckenham, S.E.)—Junior schools, Witham Road, for the E.C.; J. R. Hambridge, secretary.

(Lewisham, S.E.).—Cinema, Downham Broadway, for Super Cinemas, Ltd.; Hammond & Barr, Ltd., builders, 52, Beauchamp Place, S.W.

(Bermondsey, S.E.).—Rehousing scheme, Grange Road; borough engineer.

LONGNIDDRY.—School (£11,359); master of works, East Lothian Education Authority, Haddington.

MAIDSTONE.—Housing scheme (159), Mote Park estate, for the T.C.; borough surveyor.

MANCHESTER.—Enlargement of Ducie Street Central School (£16,000); S. Hey, Director of Education Offices, Deansgate.

MANSFIELD WOODHOUSE (Notts.).—Theatre (£13,000), for J. Pollard, Mansfield; Bryan Dean, architect.

MEIR.—Schools (£29,000); Stoke-on-Trent E.C.

MERTON.—School, for Surrey E.C.; W. W. Finny, secretary, Kingston-on-Thames.

MITCHAM.—Schools (1,600 places), Mitcham Road district; Croydon E.C.

NORTH BERWICK.—Hall (500 seats), for Town Council; burgh surveyor.

NUNEATON.—Baths (£25,000); borough surveyor.

ROWLEY REGIS.—Hospital (£25,000); surveyor to U.D.C.

SEDGEFIELD.—Additional 200 houses, for the R.D.C.; surveyor.

SELSDON.—Houses (46), Selsdon Park Road; T. H. Jones.

SHEFFIELD.—Houses, Greenhill estate (260), Longley estate (147); city architect.

SHIPLEY.—Municipal offices; U.D.C. surveyor.

SITTINGBOURNE.—Extensions to hospital, for the Joint Hospital Board; Marshall Harvey, architect.

SMETHWICK.—Further 90 houses, Old Chapel estate; borough engineer. Cinema, Windmill Lane; Irving Bosco, "Ducia," Lordswood Road, Birmingham. Premises, Church Lane; Birmingham Co-operative Society, Ltd. Market extensions, Windmill Lane; Lloyds Estates and Markets, Ltd. Extensions, Dartmouth Road; Birmingham Aluminium Casting Co., Ltd. Extensions, Wills Street; Wilmot Breedon, Ltd.

SOUTHEND-ON-SEA.—Hospital; Adams, Holden & Pearson, architects, 9, Knightsbridge, Hyde Park Corner, S.W. (returnable deposit of £5 5s.).

STOKE-ON-TRENT.—Estate development, off London Road; E. Kinson. Extensions, North Staffs. Technical College, for the E.C. (£14,000).

STRETFORD.—Dance hall, 433-5, Chester Road; Mrs. Reed.

TWICKENHAM.—Houses (51) at Fifth and Sixth Cross Roads; White & Moyes.

WADDON.—Film factory, Waddon Mills; J. T. R. Wildman, 189, Regent Street, W.1.

WATFORD.—Re-erection of factory, Bushey Hall Road, for the Ellam Duplicating Co., Ltd.

WELLINGBOROUGH.—Housing scheme (98), Croyland estate, for the U.D.C.; surveyor.

WINSFORD.—Housing scheme (60), for the U.D.C.; Peter Heaton, surveyor (returnable deposit of £2 2s.).

WOLSTANTON.—Hospital: Board of Guardians.

WOLVERHAMPTON.—Schools, Bushbury Hill, Parkfield and Bradmore; J. A. Warren, director of education.

WORKSOP.—Housing scheme, Carlton, for the R.D.C.